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THE CHAMBLY CANAL:
A STRUCTURAL HISTORY OF THE LOCKS

by
Sandra J. Gillis

(1975)

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PARCS CANADA
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History of the Locks,
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ix Abstract
x Note on the Numbering System
xi Preface
1 Introduction
1 Establishment of a Commission, 1829
3 The First Stage of Construction, 1831-35
6 The Second Stage of Construction, 1840-42
7 Reconstruction: Round One, 1848-60
9 Reconstruction: Round Two, 1869-72
10 Rebuilding the Locks: Round Three, 1880-98
11 The Twentieth Century
Lock 1
26 The Specifications, 1840
27 Construction, 1840-42
28 The Lock as Built
31 Maintenance, 1843-80
31 Rebuilding the Lock in Timber and Masonry, 1880-86
33 Repairs, 1893 to the Present
35 The Lock Today
Lock 2
50 The Specifications, 1840
51 Construction, 1840-42
52 The Lock as Built, 1842
53 Maintenance, 1843-81
54 Rebuilding the Lock in Timber and Masonry, 1882-98

56 Repairs, 1914 to the Present
57 The Lock Today
Lock 3
66 The Specifications, 1840
67 Construction, 1840-42
67 The Lock as Built, 1842
69 Maintenance and Repairs, 1842-81
70 Rebuilding the Lock in Timber and Masonry, 1882-92
71 Maintenance, 1893 to the Present
72 The Lock Today
Lock 4
78 Specifications, 1831 and 1834
79 Construction ca. 1835
80 Repairs and Maintenance, 1835-55
81 Reconstruction, 1856-59
81 Repairs, 1860-70
81 Reconstruction in Masonry, 1870-72
83 Rebuilding the Lock in Timber and Masonry, 1881-90
84 Partial Rebuilding in Concrete, 1900 to the Present
85 The Lock Today
Lock 5
92 Specifications, 1831 and 1834
93 Construction, ca. 1835
94 Maintenance and Repairs, 1835-56
95 Reconstruction in Masonry, 1857-80
96 Partial Rebuilding in Timber and Masonry, 1885-93
98 The Twentieth Century
99 The Lock Today
Lock 6
104 Specifications, 1831 and 1834
105 Construction, ca. 1835
106 Repairs and Reconstruction in Masonry, 1848-82
108 Rebuilding the Lock in Timber and Masonry, 1882-92
110 Repairs and Rebuilding in Concrete, 1900 to the Present

110 The Lock Today
Lock 7
118 Specifications, 1831 and 1834
119 Construction, ca. 1835
120 Repairs, 1848-56
121 Reconstruction in Masonry, 1856-59
121 Reconstruction in Masonry, 1870-72
122 Repairs, 1874-90
123 Rebuilding the Lock in Timber and Masonry, 1881-94
124 Repairs and Partial Modification in Concrete, 1900 to the Present
125 The Lock Today
Lock 8
132 Introduction
132 Specifications, 1831
134 Construction, 1833
135 Enlargement Specifications, 1834
136 Enlargement, 1834-35
136 Orders to Enlarge, 1842
136 Specifications, 1840
137 Enlargement, 1842
137 The Lock as Built, 1842
138 Maintenance and Repairs, 1843-57
139 Partial Reconstruction in Masonry, 1858-81
140 Rebuilding the Lock in Timber and Masonry, 1882-95
142 Maintenance and Modification, 1895 to the Present
142 The Lock Today
Lock 9
156 Specifications, 1831 and 1834
157 Construction, 1834
157 Repairs and Maintenance, 1834-73
158 Reconstruction in Masonry, 1873-85
159 Rebuilding the Lock in Timber and Masonry, 1886-88
159 Repairs, 1899-1900

160 Repairs and Modification in Concrete, 1823 to the Present
160 The Lock Today
Gates and Gate Mechanisms
170 Gates Installed on the Locks in 1834 and 1835
176 Gates Installed on the Locks Completed in 1842
180 New Gates, 1850
182 Improvements to the Gates, 1892-1901
183 The Gates as Seen in Photographs, 1894-1911
185 New Gates, ca. 1904-11
186 Replacement of the Balance Beams with Machinery
188 The Lock Gates Today
188 The Gate Covering
189 The Wall Sluices
210 Appendix A. Peter Fleming's Report, February 1830.
220 Appendix B. Contract for the Construction of the Chambly Canal, 5 September 1831.
243 Appendix C. The Contract for Enlarged Locks, 1834.
253 Appendix D. The Andres's Claim, 1835.
260 Appendix E. The Contract for Completion of the Canal, 1840.
279 Appendix F. Extract of Lander, Whitlaw and Tennant Claims for Locks, 1843.
283 Appendix G. Materials for Rebuilding Portions of Locks 2, 3, 4 and 6, 1890-92.
288 Appendix H. Specifications for Partial Rebuilding of Locks 4 and 7, 1870.
292 Appendix I. Report by P. Panjwani on Excavations at Locks 6 and 7, 1974.
295 Appendix J. Estimate for Repairs of Lock 3, 1858.
297 Appendix K. Annual Maintenance on the Locks and Gates, 1895-96.
301 Appendix L. Requisitions for Tools, Chambly Canal, 1862 and 1864.
305 Endnotes
328 References Cited

Illustrations

14	1	Map of the projected route of the Chambly Canal, 1832
24	2	The Chambly Canal as completed, 1842
39	3	Plan for the reconstruction of Lock 1, ca. 1882
41	4	Photograph of the flight of locks, 1904
43	5	A view of the combined locks, 1904
45	6	A view of the combined locks, 1943
47	7	The west wall of lock 1 during repairs, 1954
49	8	Lock 1, 1973
59	9	Plan for the reconstruction of Lock 2, 1882
61	10	The upper east wall of lock 2, 1911
63	11	The upper west wall of lock 2, 1954
65	12	The upper west wall of lock 2, 1973
73	13	Plan for the reconstruction of the upper lock, ca. 1882
75	14	A view of the combined locks from the upper gates of lock 3, 1891
77	15	Lock 3 in 1973
87	16	Plan for the rebuilding of lock 4, ca. 1882
89	17	The upper west wall of lock 4, 1935
91	18	Reconstruction of parts of lock 4, 1935
101	19	Plan for the reconstruction of lock 5, ca. 1882
103	20	The lower entrance to lock 5, 1944
113	21	Plan for the reconstruction of lock 6, ca. 1882
115	22	Lock 6, looking north, 1904
117	23	The chamber walls, 1973
120	24	The upper entrance to lock 7, 1911
129	25	The lower entrance to lock 7, 1933
131	26	The upper east chamber, recess and wing walls of lock 7, 1937
145	27	Plan for the reconstruction of lock 8, ca. 1882
147	28	The upper entrance to lock 8, 1911

149	29	Demolition of the west chamber wall of lock 8, 1967
151	30	Demolition of the west wall at the upper gate, 1967
153	31	Demolition of the west wall at the lower gate
155	32	Lock 8, looking north, 1973
163	33	"Bird's eye view of St. John's, P.Q."
165	34	The upper entrance to lock 9, 1907
167	35	The guard lock, looking north, ca. 1904
169	36	The lower entrance to lock 9, 1954
193	37	Plans for the lock gates, 1852
195	38	Plan for the ironwork for the lock gates, 1852
197	39	The upper gates of lock 5, 1904
199	40	The upper gates of lock 5, 1911
201	41	The gates at lock 2, 1911
203	42	Gates at lock 7, 1911
205	43	Gates and gate mechanisms, lock 4
207	44	The upper west gate, lock 4, 1973
209	45	Gate and sluice devices, lock 6, 1973

Abstract

This structural history of the locks on the Chambly Canal has been prepared to provide specific information on the construction of the locks and their subsequent modification, as well as on the lock gates and machinery. It is intended for the use of Parks Canada personnel for the formulation of plans for the proposed preservation-reconstruction of the locks in the system over the next 10 years.

Note on the Numbering System

To avoid confusion between the original lock numbering and the system adopted in October 1925, the present lock numbering is used throughout this report.

	Pre-1925	Post-1925
St. Jean	1	9
	2	8
	3	7
	4	6
	5	5
	6	4
	7	3
	8	2
Chambly	9	1

Preface

This structural history has been prepared to provide detailed information on the original construction and subsequent modification of the locks on the Chambly Canal. The study begins with a brief introductory chapter on the history of the canal with particular reference to the lock structures. Following that are detailed structural histories of each of the nine locks. The final chapter discusses the gates and gate machinery. Contracts, specifications and other documents too long or difficult to incorporate in the text are included in appendices. The study is intended specifically for the information of Parks Canada personnel in the formulation of plans for the intended preservation-reconstruction of the locks on the Chambly Canal over the next 10 years.

It must be noted that for the convenience of the reader the present lock numbering system has been adopted in the text of this report. Where a primary document which includes reference to a lock number has been quoted, the present lock number has been placed after it in brackets.

Introduction

Establishment of a Commission, 1829

Flowing northward from Lake Champlain to the St. Lawrence River, the Richelieu River was for centuries an Indian trade route. During the 17th and 18th centuries it was fortified by the French to defend the settlements along the St. Lawrence from the British colonies to the south. After the American Revolutionary War the Richelieu River (since 1763 in British territory) became the means of transporting rafts of timber from the new states of Vermont and New York down to the port of Quebec for export to Britain. Transportation of other commodies by boat, however, was impeded by rapids and falls between St. Jean and Chambly and at St. Ours to the north, which necessitated two arduous portages of the cargoes by horse and cart.

Calls for a canal to avoid the 12-mile portage between the St. Jean and Chambly were made by merchants on both sides of the international boundary as early as the 1770s. But the British fear of facilitating an American attack upon Montreal and Quebec prevented construction of the canal during this period.

With the completion of the Champlain Canal in 1821, which provided uninterrupted navigation from Lake Champlain down the Hudson River to the port of New York, and with the failure of a private corporation incorporated in 1818 to begin construction, the government of Lower Canada would wait no longer. Here was an opportunity for trade between Montreal and Quebec on the one hand and New York City on the

other which was not to be missed. Despite the disapproval of the British military, an Act was passed in 1823 to provide funds for the construction of a government owned and operated canal from St. Jean to Chambly.

Because of a rider in the 1823 Act which held back the funds until the completion of the Lachine Canal (1824) and financial problems thereafter, it was not until 1829 that a board of commissioners was appointed to undertake the construction of the Chambly Canal. Appointed to the board in that year were Samuel Hatt, as chairman, Thim. Franchère, René Boileau, William Macrae and Gabriel Marchand. (Marchand resigned in July 1831 and was replaced the following year by Eustache Soupras.)[1] A sum of £60,000 was appropriated for this work to bypass the treacherous Chambly Rapids.[2] A separate appropriation was made for the work at St. Ours, which was begun the following year.

Immediately upon this appointment the comissioners for the Chambly Canal engaged Peter Fleming, a civil engineer from Albany, New York, to survey the line of the canal and to submit plans and estimates. In his brief report submitted in February 1830, Fleming estimated that the work, including 10 masonry locks, could be done for £54,167 if the canal followed the course of the river for seven miles rather than being "wholly cut of the solid land"[3] (see App. A). Unfortunately the plans which supplemented Fleming's report have been lost. Governor General Sir James Kempt was skeptical of the low sum and submitted the scheme to Royal Engineer, Captain S.G. Melhuish in Quebec. Melhuish, without benefit of a survey or even a visit to the area, estimated the cost of the canal as a minimum of £96,745, almost twice Fleming's estimate.[4] Kempt as a result urged caution, telling the commissioners to begin construction only when they were convinced that the work could be done for a sum not much exceeding the amount appropriated.

To resolve the problem, the commissioners hired two American engineers, Messrs. Hanlon and Hopkins, to do a second survey. They were instructed to prepare plans and specifications more detailed than those submitted by Fleming, and suitable for advertising for tenders. Almost as optimistic as Fleming, Hanlon and Hopkins estimated the cost of the work as £60,300. Moreover, eager entrepreneurs soon tendered to do the work for even less. Satisfied that the work could be done within the appropriation, the board of commissioners, almost two years after its establishment, set about the task of circumventing the 12-mile stretch of falls and rapids between St. Jean and Chambly (see Fig. 1).

The First Stage of Construction, 1831-35

The contract for the construction of the Chambly Canal was awarded to a group of businessmen who had tendered to do the work for a total of £46,218 (a sum which did not include the price of the land).[5] Included in the partnership formed to construct the canal were Welcome U. Chase, William S. Shuler and John A. Sturtevant, all of Amsterdam, New York, and Samuel Andres, Jr. and Stephen R. Andres, prominent citizens of Chambly (see App. B).

With the first acquisition of lands and the signing of the contract 5 September 1831 for the construction of a canal with 10 locks, excavation of the alignment began 1 October (see App. B). The engineer in charge of the works was William R. Hopkins, not Fleming, who had fallen out with Kempt and the commissioners.[6] According to the contract, all construction was to be completed by October 1834.

By the end of 1832 the commissioners reported that the excavation for the lock pits and for 8 miles of canal was nearly complete, despite the dislocations caused by the cholera epidemic which raged throughout the province that

year. The commissioners did admit that costs were exceeding their expectations but they were still confident that the work could be done for less than £60,000.[7]

Heavy rainfall and the repeated failure of coffer-dams bedevilled the works during 1833. Nevertheless, water was allowed into the canal and boats were able to navigate from St. Jean as far as the first lock at Chambly (the present lock 8), thus facilitating the transportation of construction supplies, particularly the stone from Lake Champlain. That year the contractors were able to finish their first lock, except for the installation of the gates. Then known as Macrae's lock (and now as lock 8), it was built according to the dimensions stipulated in the 1831 contract - 100 by 20 feet.[8]

Although again troubled by cholera and the resulting difficulties with the frightened Irish labourers in addition to a shortage of funds, the contractors made considerable progress on the canal in 1834. Certainly J.B. Jervis, an independent engineer whose opinion was sought by the commissioners, presented a favourable report on the works in August.[9] The guard lock at St. Jean - 10 miles from the nearest lock at Chambly - was finished and opened by the late summer of 1834. The other locks, with the exception of the combined locks which had not yet been started and a single lock between the combined locks and lock 4 (which never was built) were nearly finished by the end of the year.[10] These locks were all built on a scale larger than Macrae's - 120 by 24 feet - for which the contractors had signed a contract in July 1834 and for which the crown had authorized an additional £3,600.[11] (For the new contract <u>see</u> App. C.) The date of completion was extended to October 1835.

By December 1834 the commissioners had expended £56,530 out of the total appropriation of £63,600.[12] Yet much,

including four (later changed to three) locks and dock facilities at Chambly and St. Jean, remained to be done. A crisis was in fact approaching. Realizing as early as 1832 that they had taken the works at too low a price and frightened by the cholera epidemic, the American contractors William Shuler, J. Sturtevant and W.U. Chase skipped across the border. After that relations among the contractors themselves and between them and Hopkins deteriorated rapidly. Finally in late 1834 or early 1835 the contractors' partnership was dissolved and the parties remaining in the area, Stephen R. Andres and Samuel Andres, Jr., agreed, from a sense of duty and family pride, to continue with the work on their own and hoped that a grateful province would compensate them for their losses.[13]

In fact the Andreses were able to make little progress in 1835, and when the contract expired in October there still remained a stretch of 1,100 feet to Chambly Basin to be overcome. That month the Andreses submitted to the Lower Canadian government their claim of £21,000 for extra work and prayed that justice be done to them and their labourers[14] (see App. D). Despite the pleading of the commissioners, additional funds were not forthcoming from the province. The labourers were dismissed and work ground to a halt.[15] The master mason and master carpenter left the following year and the project was in effect abandoned. It was only the personal initiative of the commissioners - who over the next few years purchased, sometimes with their own money without assurance of compensation, enough riprap to protect the banks from spring floods - that prevented the destruction of all that had been built.[16]

The next five years was a time of political turmoil in Lower Canada. During these years the canal lay incomplete but not abandoned, for it would appear to have been used despite the absence of lockmasters to operate the gates and

the portage over the last 1,100 feet at Chambly.

The Second Stage of Construction, 1840-42

Following the British government's guarantee of the interest on a loan to provide a measure of financial stability for the forthcoming union of the Canadas, work on the Chambly Canal resumed in 1840. The money spent did not come directly from the British treasury, but was a loan of £35,000 from John Jones of Montreal, raised on the strength of the British guarantee by the commissioners who remained in charge of the project.

Official interest in the canal had revived in 1839. That year the commissioners hired George Keefer, a member of a famous Canadian engineering family, to report on the state of the works and to make recommendations for its completion.

Keefer submitted his report later that summer. The masonry of the locks, he wrote, appeared to be substantially built, although the coping was in many cases rather roughly put down. He recommended that the unfinished piers and the wing walls be given the same batter as the chambers. His main complaint was the poor state of the cast iron paddle gates which operated not in metal frames but against the bare wood of the gates. Hence as the wood wore the gates leaked badly. He estimated the cost of completing the canal at £30,000.[17]

There had been up to this point differing plans for the location and number of locks to complete the canal. The design was settled by 3 July 1840, when the recently hired chief engineer, Nicol H. Baird, issued the specifications for the remaining sections.[18] Included among the works to be done were the construction of three combined locks at Chambly Basin and the enlargement of Macrae's lock to the standard 120 by 24 feet. Dispensed with was a tenth lock

which had been planned between the present lock 4 and the combined locks. Fortunately the specifications for these locks have survived (see App. E, part B).

The contract for the completion of the locks was awarded to the firm of Lauder, Whitlaw and Tennant of Montreal and was signed on 11 August 1840. All work was to be done by 1 October 1841. Work was begun by the end of August 1840.[19]

Construction of the combined locks and the enlargement of lock 8 were plagued by countless difficulties: the illness of Baird and his replacement by George Keefer in October 1840; the problem of getting sufficient stone from Isle La Motte; a scarcity of labourers; the repeated failure of coffer-dams; delays with receiving the money from John Jones, and almost constant bickering between the contractors and the engineers.

In the late fall of 1842 Keefer announced the completion of the canal, almost one year behind schedule and over eleven years after the first sod had been turned. (In fact, some work was left incomplete; canal engineer J.F. McDonald wrote in 1851 that the coping on some of the locks had not been laid at the time of construction and still remained unfinished.)[20] Too late in the season then to open the work, it was not until 25 May of the following year (1843) after the ice had melted that boats - less than 108 by 23 feet and drawing less than 5-1/2 feet - were finally able to navigate the whole 12-mile length of the Chambly Canal (see Fig. 2).

Reconstruction: Round One, 1848-60

From the beginning the canal was busy. Unfortunately, the class of vessel which began to see service on it bore little resemblance to those common when it was designed. In the late 1820s and early 1830s horse-drawn sailing barges were

the principal users. By mid-century, however, powerful paddle-wheel steamers were making their way up and down the inland waterways of the continent. As these heavy steamers thudded into the chamber walls and as the paddles thrashed along the top of the too low coping, the masonry shuddered under the impact. This punishment, combined with very poor maintenance, meant that after the passage of not too many years, the lock structures began to show signs of wear.

The crunch came in 1848. On 2 September, the canal had to be closed when the walls of lock 6 threatened to collapse. The west wall (and perhaps the east wall) of the lock had to be rebuilt, leading the commissioners of Public Works to remark bitterly, "It appears that the walls of these locks are much too thin, and the materials of which they are constructed, are of inferior quality, and the work itself badly done."[21] Moreover, it was apparent that similar reconstruction would have to be done on locks 7, 5 and 4. Yet it does not appear, from the available evidence, that the necessary rebuilding took place. Repairs over the next few years seem to have consisted only of completing unfinished portions of coping, clamping and bolting the coping to the third course of masonry, and driving wooden wedges between the facing stones to keep them in place. To equalize the pressure on the walls the locks were kept full of water except when vessels were passing through. Timber fenders were placed along the wing walls to protect them from damage. The canal staff was also ordered to give extra protection to the wing walls with piling, though whether the orders were carried out is not known.[22]

The main effort during these years was directed toward deepening the prism of the canal in order to raise the water on the sills to a uniform seven feet, and toward replacing the old defective gates with new ones based on a new design. The result was that in 1853 the commissioners reported that

"the works of this Canal are in a very ruinous condition. Locks 2, 3, 4, and 5, [now locks 8, 7, 6 and 5] particularly are in so bad a state, that it would be necessary to rebuild them."[23]

Unfortunately for the efficient maintenance of the canal, the question of an entirely new alignment, directly between Montreal and the Richelieu River, was under serious political discussion. Hence over the next few years only minimal maintenance was carried out to avoid total collapse. As the 1855 report of the commissioners put it, the canal had been maintained, without interruption to the navigation in as passable a state as its ruinous condition would admit.[24]

By the mid-1850s action could be postponed no longer. The proposed Champlain and St. Lawrence Canal remained only a series of consultants' reports, with little prospect of the nebulous fog of verbiage floating around the Executive Council ever coalescing into a concrete decision. Between 1856 and 1860 extensive portions of locks 4, 5, 6, 7 and 8 were taken down and rebuilt.[25] By 1861 the commissioners were able to report that the locks generally were "in a much better condition than they were a few years ago," despite the fact that locks 9 and 3 were leaking badly.[26] By that year the widths of the locks seem to have been reduced by about six inches from the original 24 feet by the action of the frost.

Reconstruction: Round Two, 1869-72

For the next few years the canal seems to have settled into a relatively maintenance-free state. Yet scarcely had the former colony taken its first steps toward nationhood than the familiar theme began to reappear. In 1869 the minister of Public Works was forced to report that several locks on the canal were in a state of decay and that extensive repairs would have to be undertaken shortly.[27] As a result,

over the next six years, sometimes considerable portions of locks 1, 4, 5, 6, 7, 8 and 9 were taken down and rebuilt.[28]

According to John G. Sippell, superintending engineer of the Quebec canals, in 1869, the work of reconstruction was to be done according to a new plan, designed to overcome the too light masonry in the locks.[29] The evidence indicates, however, that his suggestion was not accepted. Once again the question of an improved St. Lawrence-Lake Champlain waterway was a hot political issue,[30] and, in the face of this, the repairs and reconstructions were again done without a view to permanency.

Certainly it was not long before the lock structure once again began to show signs of decay, although an effort was made to stave off movement of the chamber walls by bracing them each winter with a timber framework inside the chamber. It was to no avail, for by the end of the decade the piers on the east side and the lower west wing wall of lock 6 had to be taken down and rebuilt with new stone.[31] Minor work was carried out on the other locks during the same period. Nevertheless by November 1880 all the locks were described by the recently appointed superintending engineer, E.H. Parent, as "delapidated" while the combined locks, even worse, were in a "most dangerous condition."[32]

Rebuilding the Locks: Round Three, 1880-98

In 1880-81 there began a programme of rebuilding that left the locks standing more or less as most of them do today. That winter the face of the upper east wall of lock 1 was taken down and rebuilt in timber and concrete to the level of the canal water and in masonry above.[33] The rebuilding of the locks in this half-masonry, half-timber style was not carried out on an orderly lock-by-lock basis, but in a piecemeal fashion: half a wall one year, a hollow quoin a few years later, then the rest of the wall the next year.

Nor were all the locks done in precisely the same manner.[34] Furthermore, plans drawn up about 1882 by J.E. Doré for an orderly rebuilding program seem to have been rejected or at least ignored during the progress of the work. Nevertheless, by 1893 the process of rebuilding the locks to the "half-timbered" style seen by boaters today had been carried out on all but the west chamber wall of lock 4, the west wall of lock 5, the east side of lock 7, and the wing walls of various locks. (Precisely why this style was adopted is not answered in available correspondence, but it was presumably because of the relative cheapness and availability of wood in comparison to stone.) At the same time entrance walls, consisting of timber cribs filled with stone, were built to protect the wing walls from damage.

Locks 7 and 5, while not fully rebuilt, nevertheless could not be long ignored. Over the winter of 1893-94, 21-foot bars were put through the west wall of lock 7 and secured with bolts to heavy timbers placed in a trench in the rear to prevent the wall from tilting inward. A similar piece of work was carried out several years later on the wing walls of lock 1 where they had become detached from their backing and were in danger of falling in on the gates.[35] With the exception of rebuilding portions of lock 2 in 1894-95 and the east abutment wall between combined locks 2 and 3 in 1897-98, this represents the last major work in the 19th century. By 1898 the department felt confident that the canal was "in a very good state of repair."[36]

The Twentieth Century

If in terms of the Chambly Canal the 19th century might be considered the age of stone and timber, the 20th has certainly been the age of concrete. Engineers and builders were slow to accept this convenient material in lieu of stone masonry, but once concrete was shown to be stable and

hard-wearing, its use was embraced with a vengeance, and most renewals and new work were thereafter carried out in concrete.

The first major work done in this fashion was the replacement of the old stone and wooden sills with concrete, a task which was completed on most of the locks by about 1910.[37]

In the years immediately preceding World War I, further work was undertaken: the plank floors of many of the locks were covered with concrete; in 1914 the rear face of lock 8 was excavated and a 10-inch thick layer of concrete poured in the trench, a measure which effectively stopped all leaks.[38]

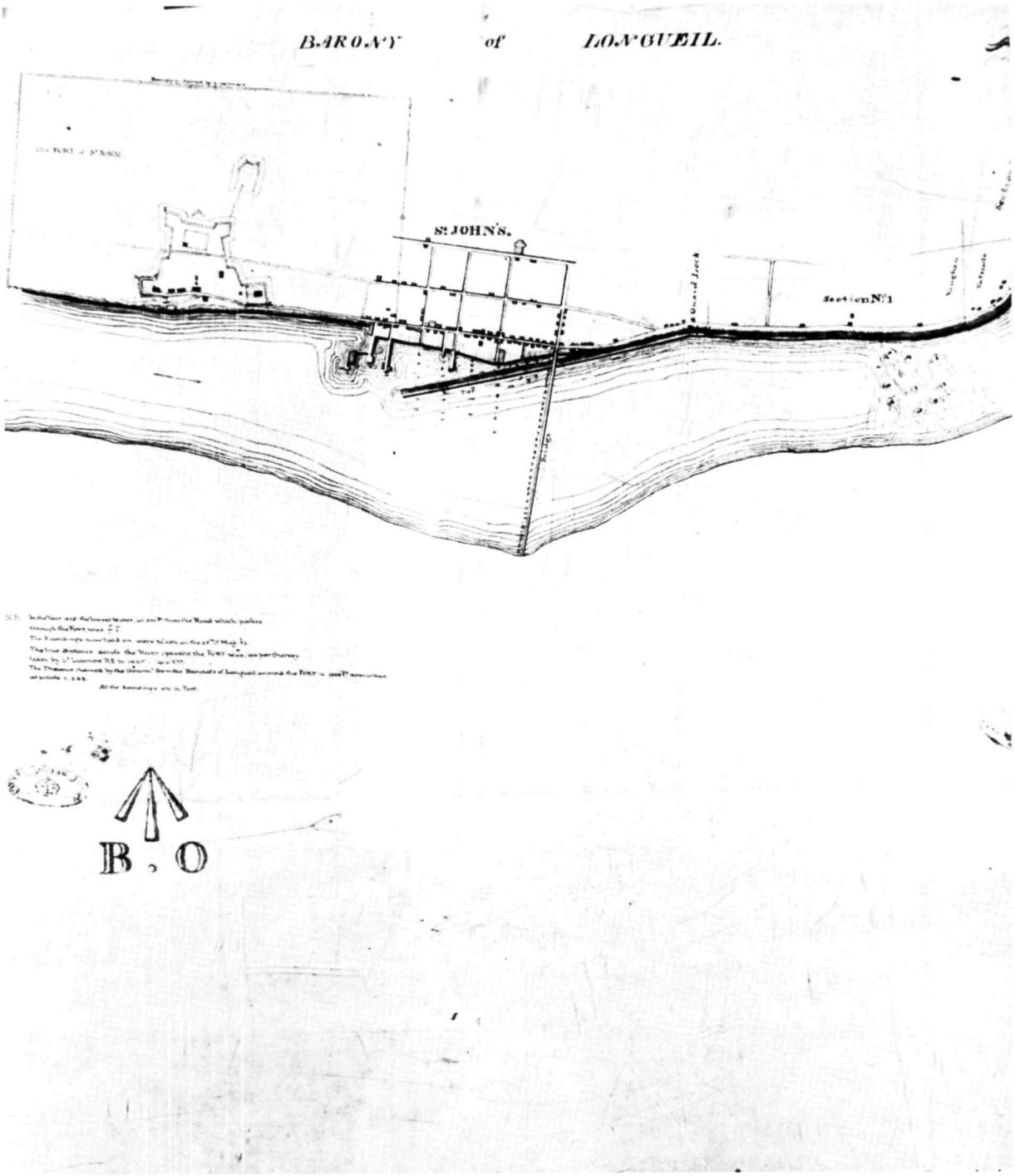
The war years caused the suspension of all but the most important works on the canal. The only major works carried out during these years were the removal of part of the masonry of the west wall of lock 2 and its replacement with concrete, and the rebuilding of the lower west wing wall of lock 6 in timber and masonry.[39]

It was not until 1923, in fact, that major repair work to the lock structures was resumed. That year the floor and sill of lock 9 were renewed in concrete. The following year, the lower east wall and lower apron of lock 8 and the wooden apron at the lower end of lock 4 were rebuilt in reinforced concrete. Then in 1925-26, half of one of the chamber walls in lock 5 and part of one of the wing walls of lock 3 were taken down and rebuilt.[40]

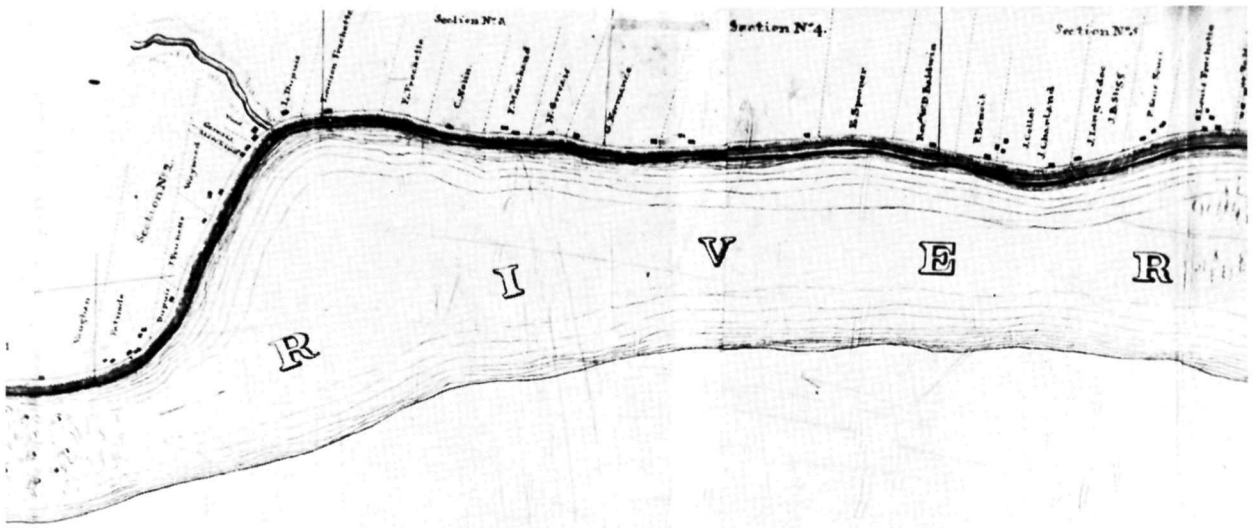
The last few years of prosperity before the Depression saw little major work done on the locks. The collapse of the world economy in 1929, however, spurred on repair projects on the Chambly, as much to "make work" as to supply cheap reliable water transport for primary industry. During the early 1930s steel plates were insalled in all the quoins to protect the masonry and timber from the constant friction

of the gates. During the middle years of the decade the wooden entrance walls and aprons of most of the locks were replaced by concrete as were large portions of the chamber walls on the west wall of locks 4 and 7 and of the east wall of lock 7.[41]

After the International Joint Commission's studies in the 1930s suggested the possible replacement of the historic Chambly Canal by a major shipping route along the river by the means of dams, the locks were again allowed only minimal maintenance. It is perhaps the small budgets for the Chambly Canal in the past which have saved many of the historic structures in the canal system from replacement or modernization. At the same time the resulting deterioration has often prompted action when collapse of a wall seemed imminent. This has usually involved the replacement of the 19th-century stone and timber structures with concrete, thus altering the historic fabric of the locks. In the late 1960s, for example, the west walls of locks 8 and 9 were taken down and replaced with concrete. At the present time, plans for re-routing part of the canal out into the river from St. Jean to Ste. Thérèse Island may involve the removal of lock 9 and at least 4 miles of the historic canal route and tow-path. The remaining eight miles, however, are apparently considered to have historical value. This section is to be preserved and the eight locks at Chambly are to be restored to their 19th- or early 20th-century appearance.



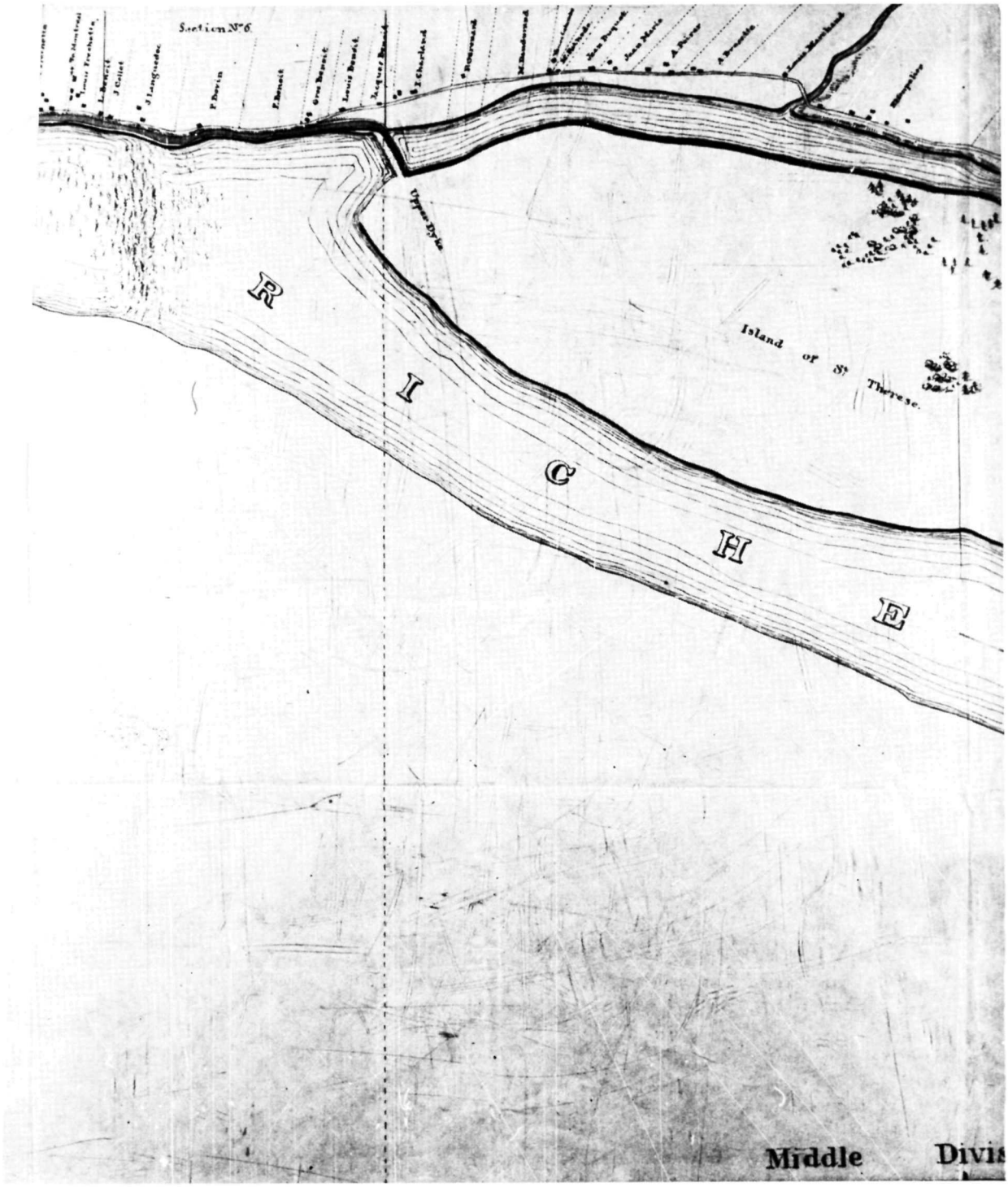
1 Map of the projected route of the Chambly Canal, drawn up by the Royal Engineers, 1832. Note that this plan calls for 10 locks, rather than the 9 which were finally built (Public Archives of Canada.)



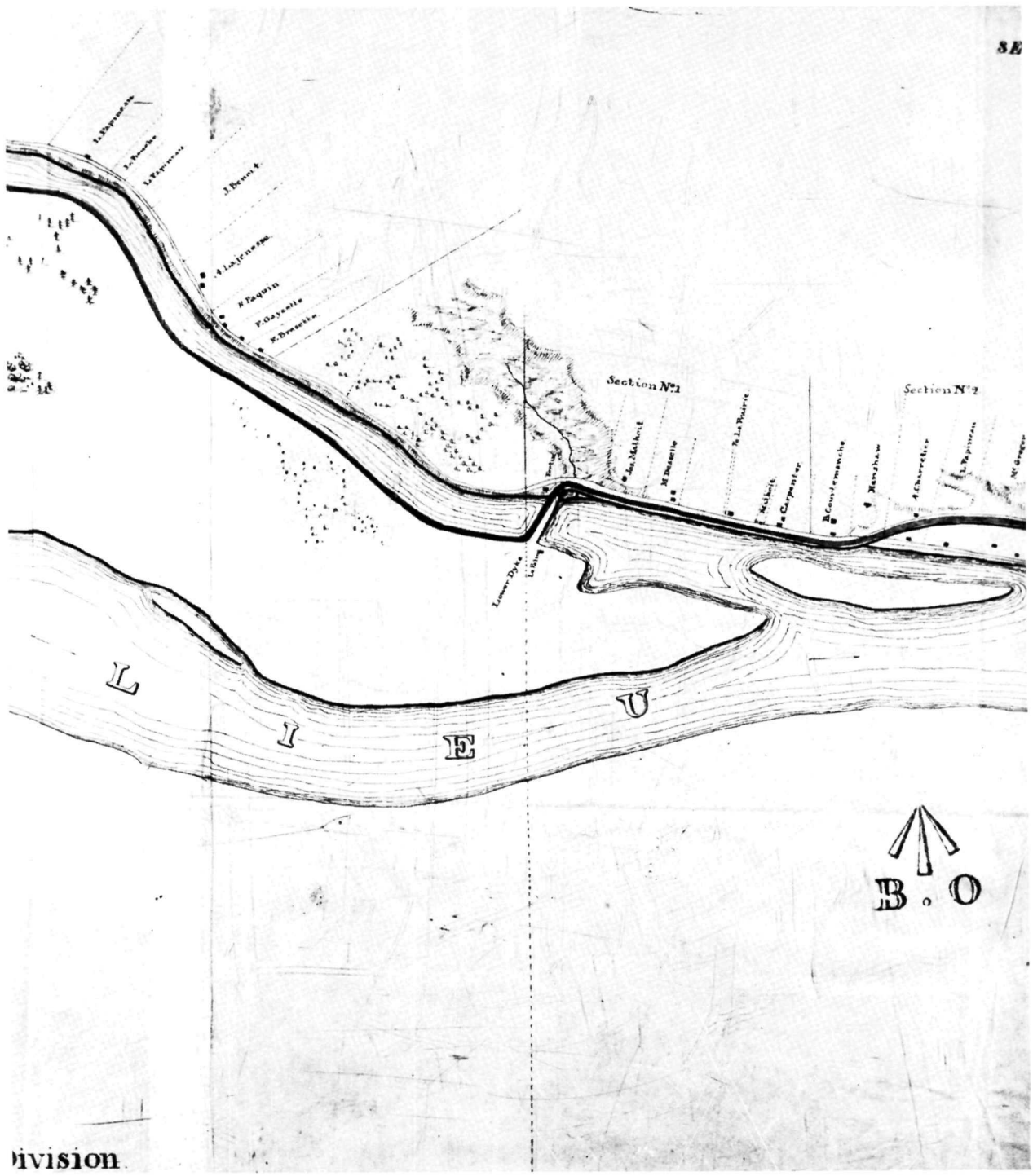
B . O

Division

1b



lc



ivision

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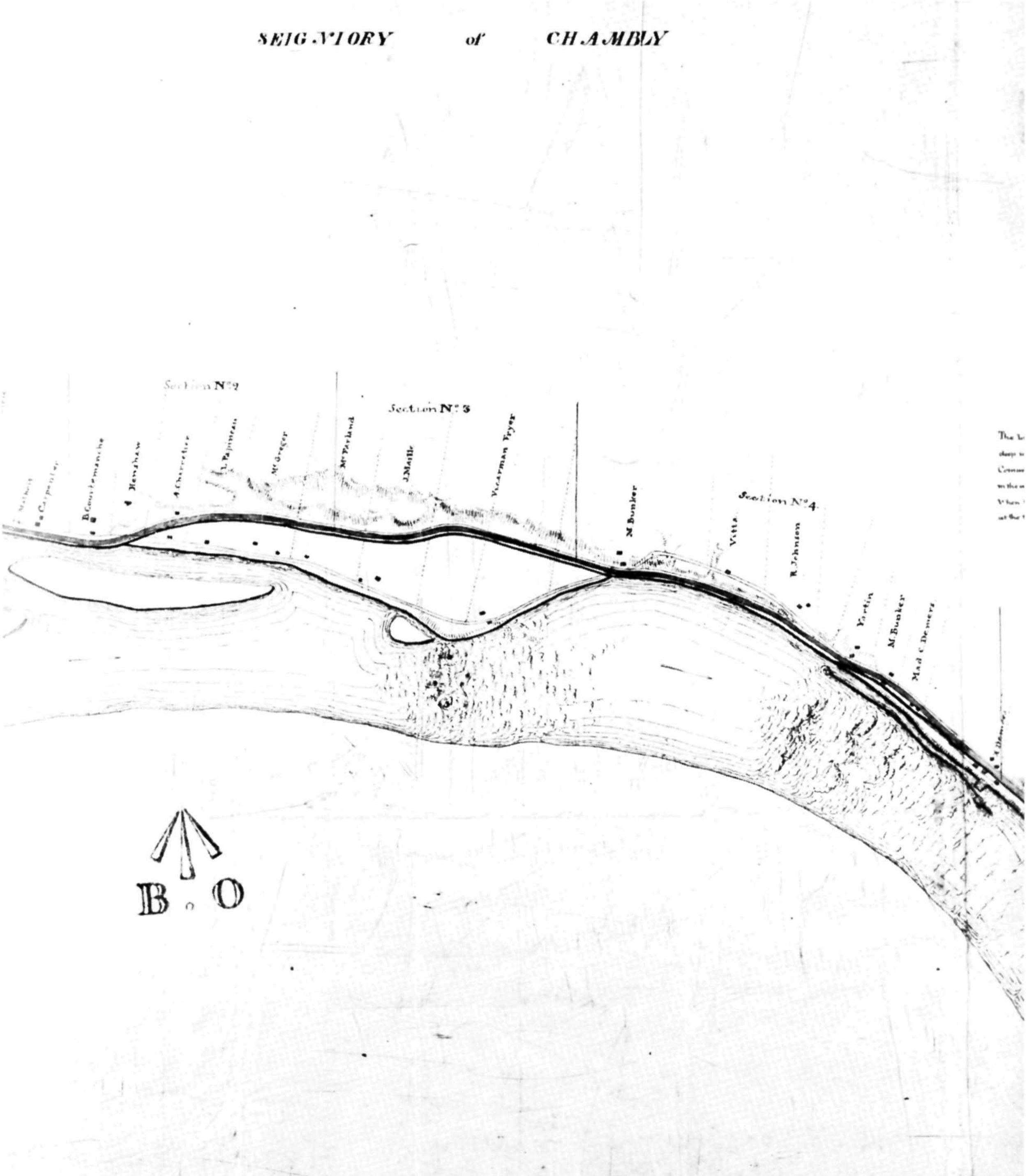
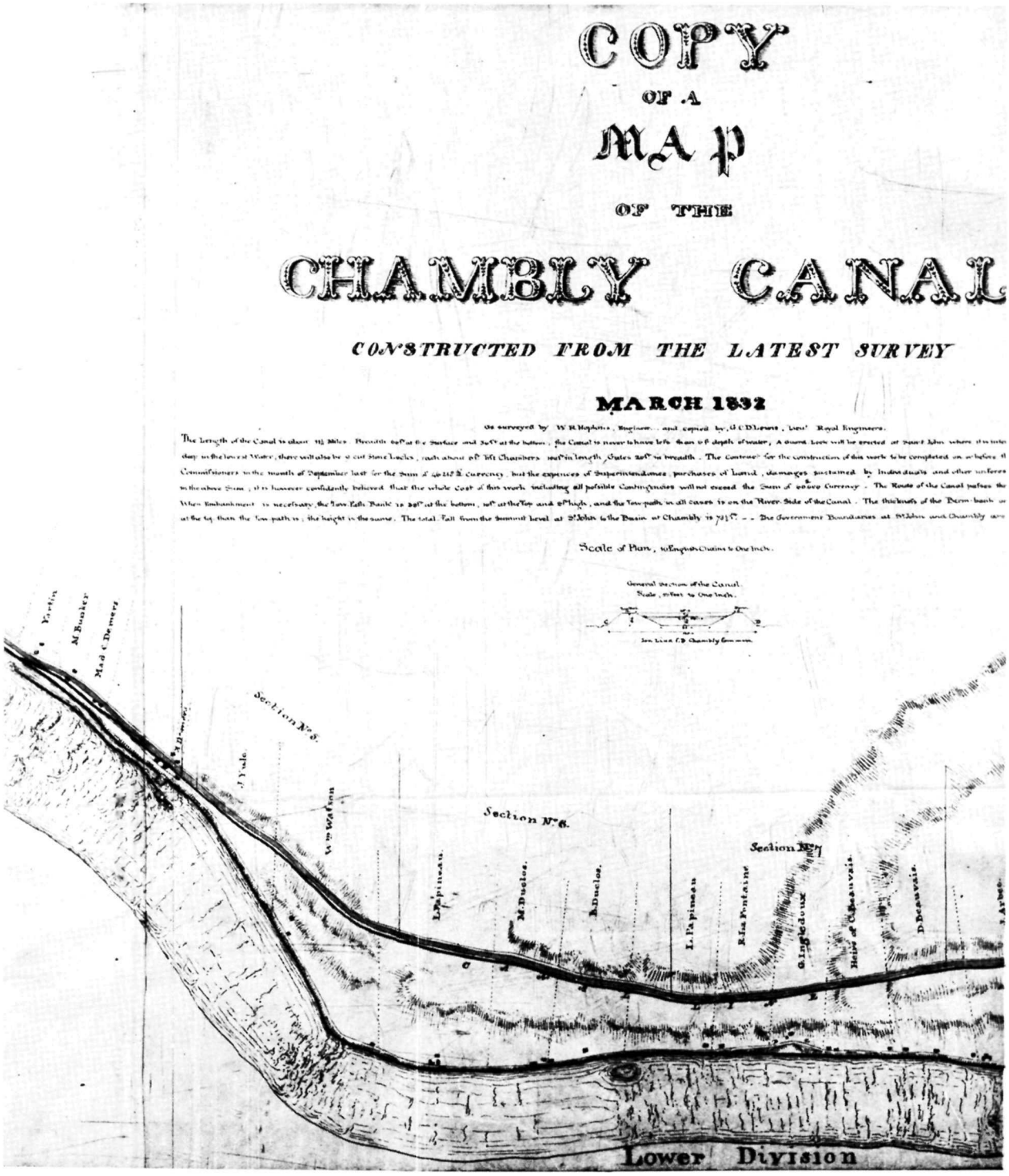
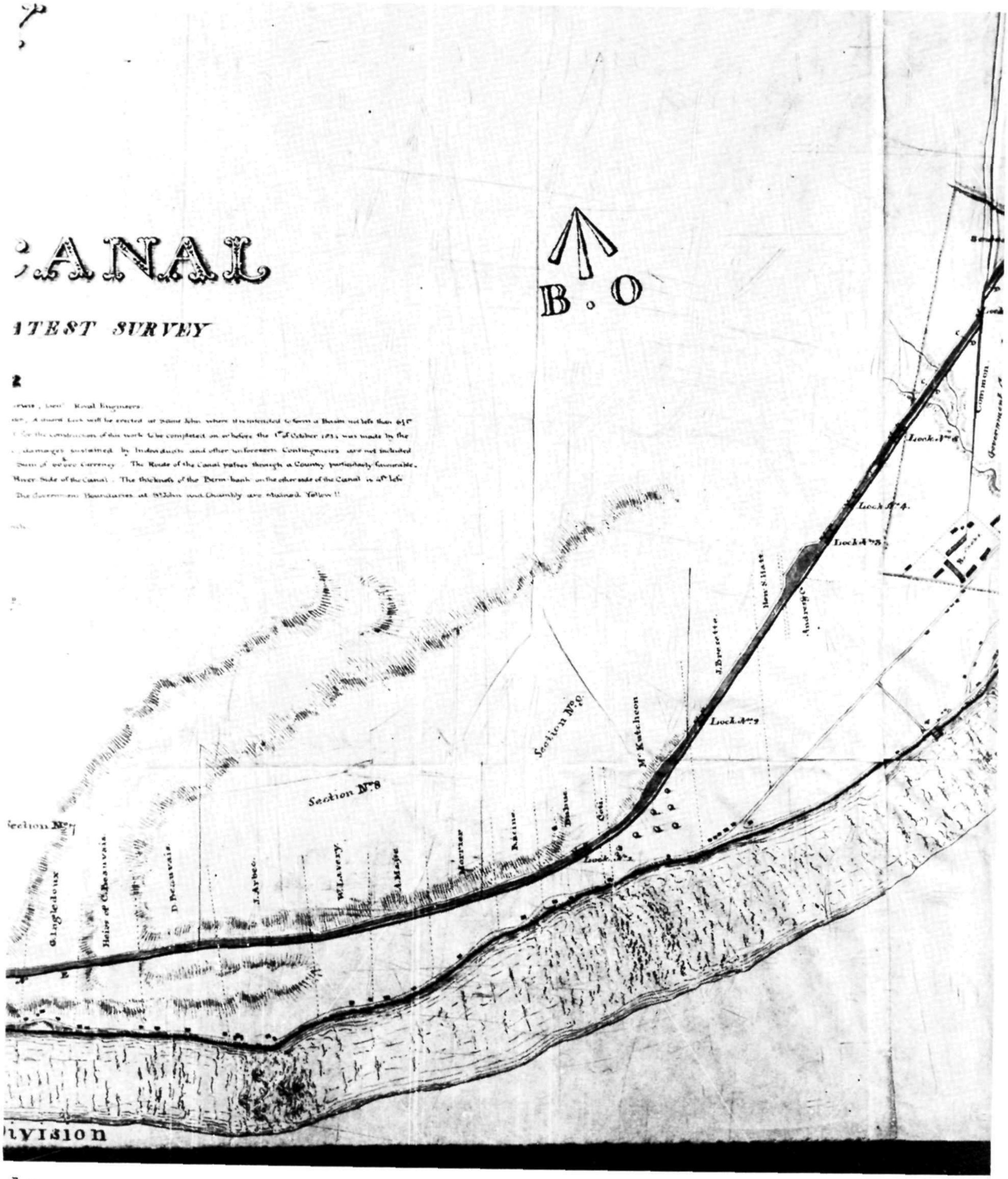

SEIGNIORY of CHAMBLY
Section No 2
Section No 3
Section No 4
M. Bunker
R. Johnson
M. Bunker
B O

le

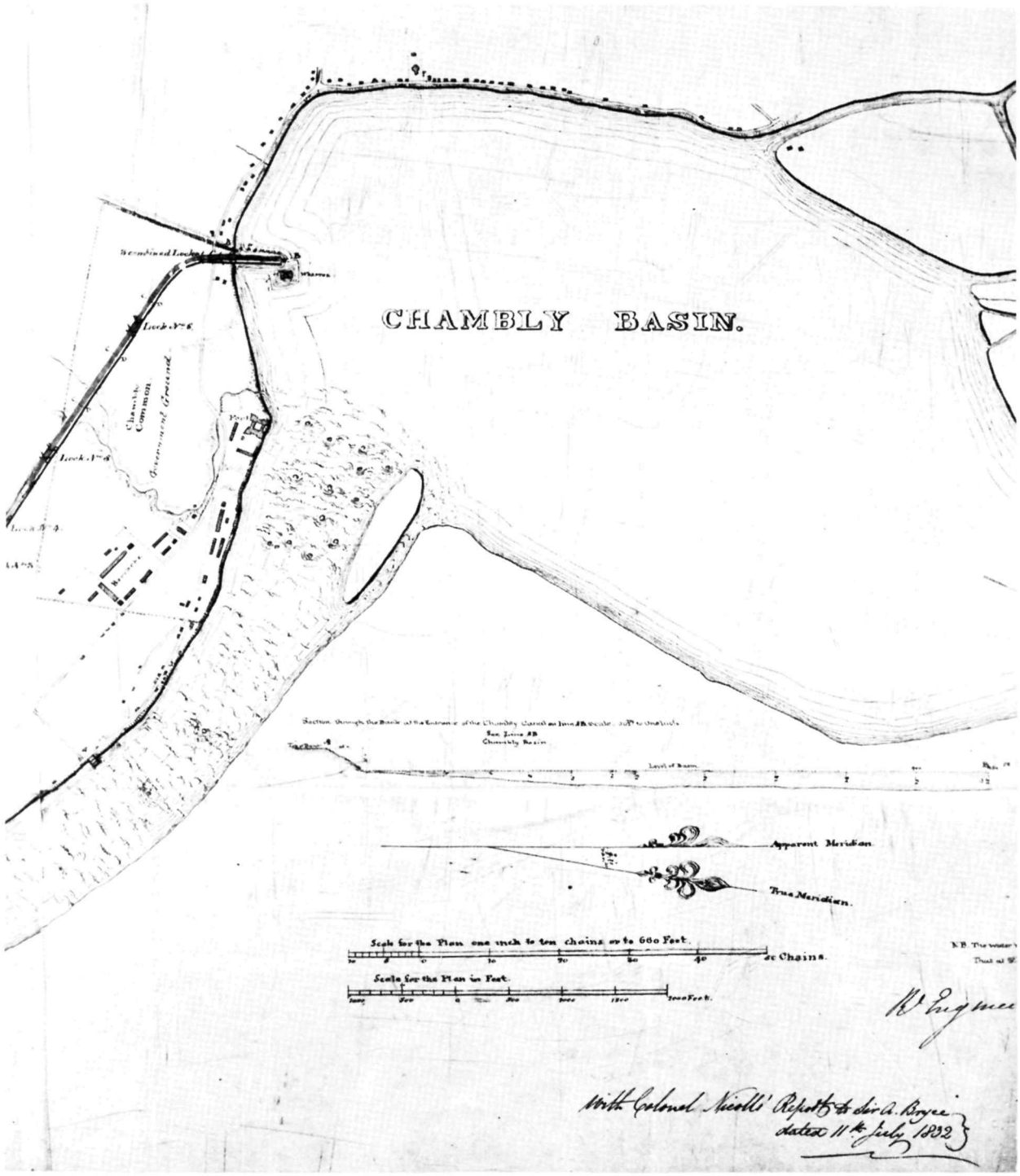

COPY
OF A
MAP
OF THE
CHAMBLY CANAL
CONSTRUCTED FROM THE LATEST SURVEY
MARCH 1832
Scale of Plan, 10 English Chains to One Inch.
General Section of the Canal.
Scale, 10 feet to One Inch.
Section N°8.
Section N°6.
Section N°7
Lower Division

lf

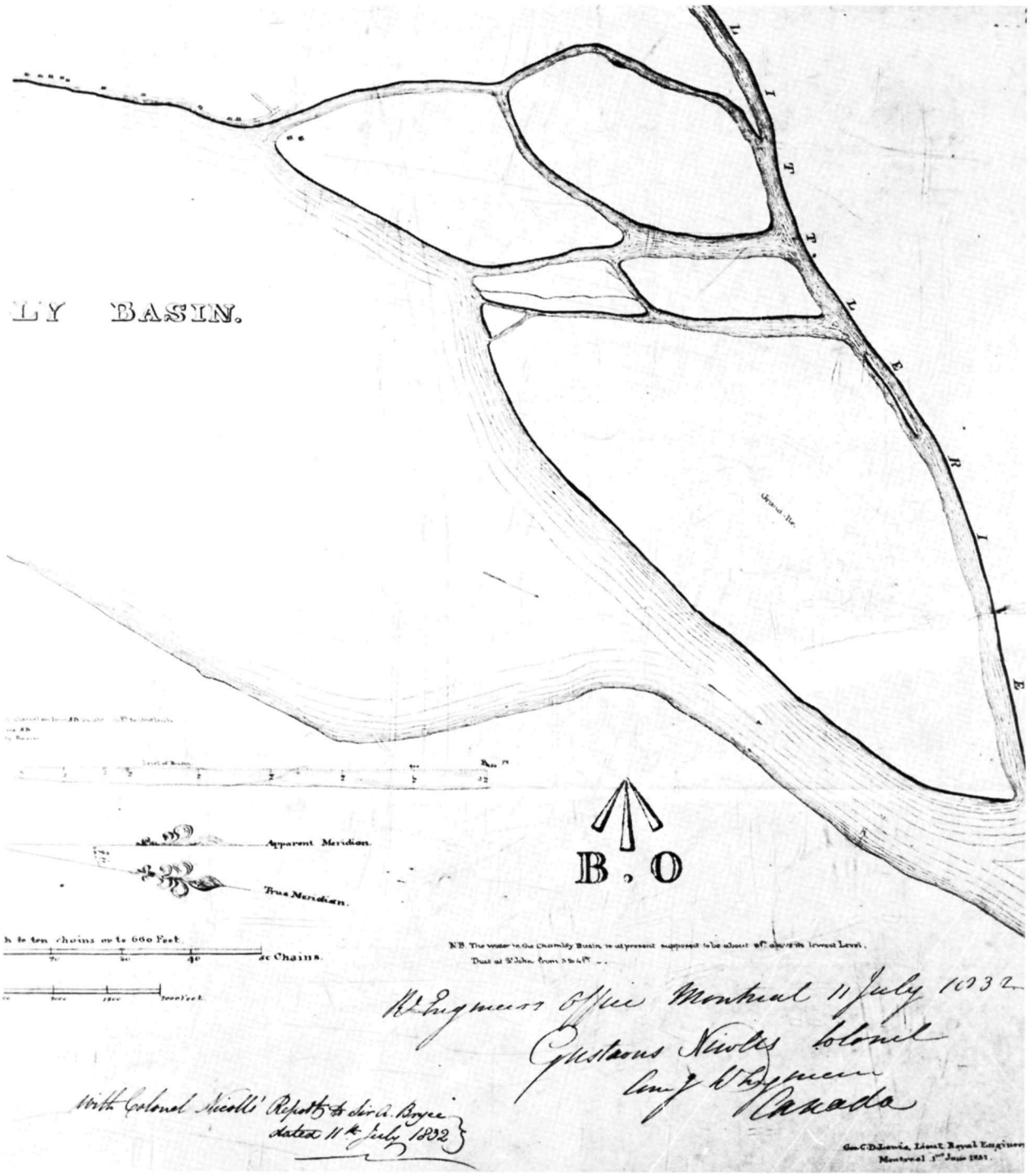


CANAL
ATEST SURVEY
B.O
Section No 7
Section No 8
Section No 9
Lock No 3
Lock No 4
W. Lavery
J. Arbec
D. Beauvais
M'Kutcheon
J. Brouette
Division

1g

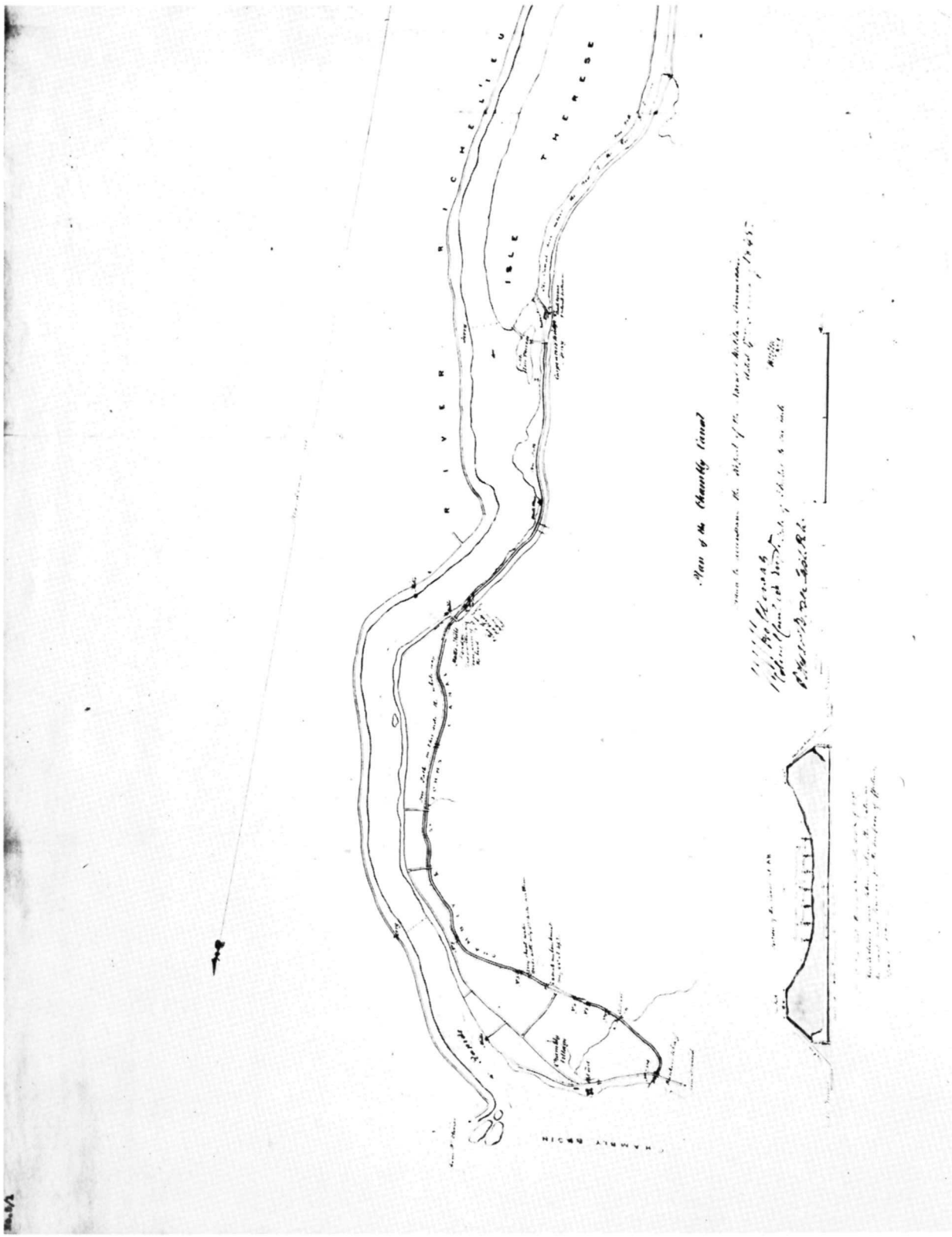

CHAMBLY BASIN.
Lock N°6
Lock N°5
Church
Common
Government Ground
Apparent Meridian.
True Meridian.
Scale for the Plan one inch to ten chains or to 660 Feet.
Chains.
Scale for the Plan in Feet.
Feet.
With Colonel Nicolls' Report to Lieut. A. Boyce
dated 11th July 1832

lh

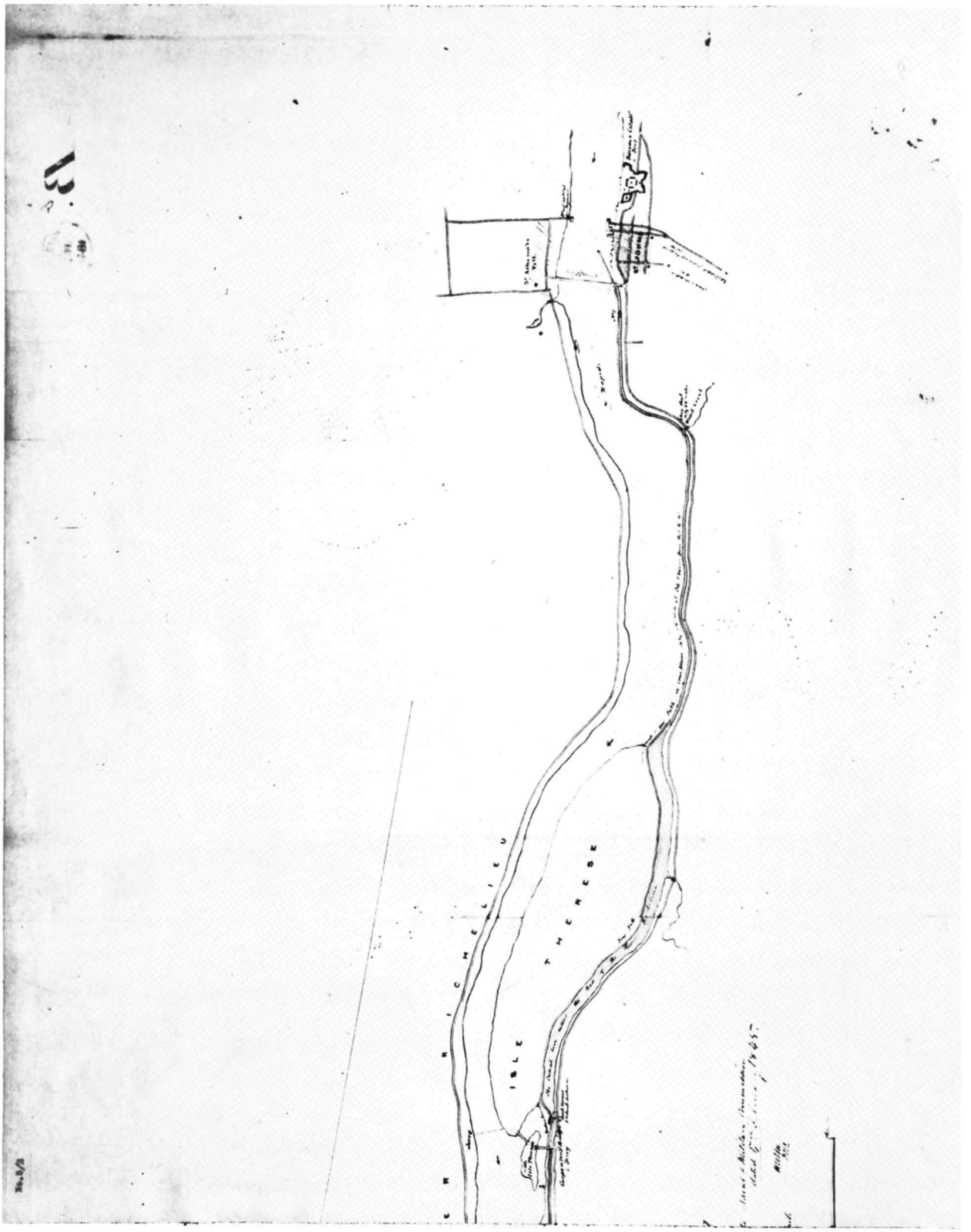

LY BASIN.
Apparent Meridian.
True Meridian.
B. O
With Colonel Nicolls' Report to Sir A. Bryce
dated 11th July 1832

li

2 Royal Engineers map, dated 1845, of the canal as it was completed in 1842. (Public Archives of Canada.)



2a



2b

Lock 1

The Specifications, 1840

With the intended resumption of work on the Chambly Canal, specifications for the combined locks at Chambly Basin were drawn up and a contract for their construction signed in August 1840 with the firm of Lauder, Whitlaw and Tennant. All work was to be completed by 1 October 1841.

According to the rather confusing and sometimes vague specifications,[1] the lower entrance lock, the first in a flight of three, was to be 24 feet wide between the piers and 120 feet long from the pointed sill to the breastworks. (See App. E, part B. Unfortunately the plans referred to in the specifications have not been located.) It was to have a lift of 11 feet 6 inches with 6 feet of water on the upper mitre sill and 7 feet on the lower. The proper foundation for the lock was to be determined by the engineer on the site, based upon the particular requirements of the soil, the nature of which had not yet been ascertained. If the nature of the ground required extra strength and stability, the engineer could use inverted masonry arches laid on a rubble bed; otherwise he might order a timber foundation consisting of longitudinal and transverse layers covered with plank. Piles were to be used to give extra solidity if required.

The walls of the lock were to be of ashlar masonry at the face, "bedded fully with water lime," and backed with rubble set in mortar and grouted with hot lime, all of a width of 8 feet at the bottom and 5 feet at the top.

Helping to support the structure were to be five counterforts on each side of the chamber. The walls were then to be backed with an 18-inch layer of fine quality puddling, embanked with the material excavated from the lock pit, and top-soiled and grassed. The wing walls at the lower entrance were to be of similar masonry and built with two sets of grooves on the face for the placement of stop logs.

Masonry wall sluices, 4 feet by 2 feet, were to be made in the walls at the upper end of the lock to carry the water from the gate recess of the lock above, past the breast wall and mitre sill between them and into the lower chamber. How the water flow through the sluices was to be regulated is not mentioned in the specifications.

The upper mitre sill and the breast wall arch, the height of the lift, were to be built as a unit of stone masonry supported by piles. (Thus the gate was to hang over the breast wall.) The lower mitre sill was to be of oak timber, protected from the action of the water coming through the sluices on the lower gates by rows of sheet piling secured to it and to a parallel lower wooden sill. Two additional sills were to be placed between the wing walls in the grooves designed for stop logs; more sheet piling was to be placed between. All the spaces between the sills were then to be filled with "pitching" (tar, perhaps) or square timber grouted with lime or cement, as determined by the engineer on the site.

Construction, 1840-42

Excavation of the lockpit and basin below began almost immediately after the signing of the contract in mid-August 1840. Lauder, Whitlaw and Tennant's initial efforts were wasted, however, when the engineer in charge of the work,

Nicol H. Baird, decided to move the lower entrance of the canal 60 feet to the northwest of the present site. To further slow progress that year, the repeated failure of coffer-dams and pumps prevented the complete unwatering of the area.[2]

The job of draining the lockpit was again tackled in the spring of 1841, and the task was not completed until the end of June. Excavation resumed, though the hard slate encountered made the job a very difficult one. On the other hand, the stable nature of the ground seems to have persuaded Baird's replacement, George Keefer, that it was possible to reduce the amount of sheet piling and timber in the foundations, as well as the thickness of the walls, without affecting the solidity of the lock.3 Keefer solved the problem of the unevenness of the rock base by building it up with concrete, a very early use of the material.[4]

The laying of the masonry was begun in the summer of 1841. There was less progress that summer than had been hoped, however, due to the fact that the shipments of stone from the quarry on Lake Champlain were continually far behind schedule. By the end of September the lock masonry had been raised 10 feet.[5]

The masonry work was recommenced in late April 1842 on the reduced scale ordered by Keefer and was finished, with the exception of the coping, by the first of June.[6] The final work - the laying of the coping, the puddling, the embanking, the fitting of the gate anchors and the installation of the gates - was not completed until the fall of that year when the other locks in the flight were finished.[7]

The Lock as Built

The physical evidence suggests that lock 1 was built as

closely as possible to the specifications (see App. F). There were, however, some notable modifications to meet unexpected conditions as they arose or to economize and speed up the completion of the canal. The lift of the lock was changed from the proposed 11 feet 6 inches to 15 feet 6 inches and the length to 125 feet 10 inches, the latter to compensate for the loss of usable length because of the projection of the stone breast wall and mitre sill into the lock. The strength of the rock base in most of the lockpit had allowed Keefer to reduce the number of piles used in the foundation, but sheeting (6-inch pine) and bearing piles were still necessary at the lower entrance of the lock, under the sills and under the wing walls, in the clay at river level. He had also ordered a reduction in the thickness of the rubble in the walls. The masonry in the breast wall and coping was held in place by iron bolts leaded into holes drilled into the stone. Total masonry in the lock when completed was 1,230 cubic yards, of which 230 consisted of dressed ashlar facing stones. At the same time the irregularity of the rock bed had necessitated the pouring of concrete to provide a level base for the chamber.

Keefer adopted the cut-stone inverted arch option given in the specifications; this same masonry still forms the floor of the lock chamber today. The floor of the gate recess, however, seems to have been a 4-inch planking though there is mention of recess "flagging" (flag-stone?). The arch and the planking of the recess were plaed over a longitudinal layer of flattened hemlock timber laid on the rock and concrete bed, covered in turn by a transverse layer of 11-inch sawed timbers, with the spaces between filled with concrete. Whether the rubble bed for the arch called for in the specifications was used is not known.

Not called for in the specifications, but added, was a masonry wall built as an extension of the east wing wall at

the lower entrance to the lock to protect the wings and to prevent erosion of the shore and leaking (see Figs. 3 and 5). Because the first three locks were constructed as a single masonry structure, there were, of course, no upper wing walls to lock 1. The records also mention the construction of stone steps leading up from the first to the second lock, which was not as convenient as it might seem, for it necessitated the use of wooden walkways to allow the lockmen to push the balance beams across the stairwell (see Fig. 4).

Also not mentioned in the specifications nor in the correspondence at the time of construction are several details contained in the report of the Department of Public Works in 1867, all of which would have been original features of the lock. The embankments, except at the east side of the entrance where they were confined by the previously mentioned stone wall (of which the top 8 feet were of cut-stone masonry) were said to be 15 feet wide with outside slopes of two to one. Width of the lock in 1867 was reported as 23 feet 9 inches, perhaps a little short of the original width due to frost action. Further, the departmental report for 1939 mentions that the outside face of the wooden apron below the lower mitre sill was protected by a row of sheet piling driven down to rock and reinforced in front by stone piles, all probably there from the beginning.[8]

Unfortunately the sketchy nature of the contemporary documentation makes it impossible to determine what other adaptations may have been made to the specifications during construction of the lock. Many questions remain unanswered. The contractor's monthly estimates give in detail the total quantities of materials used - 993 feet of 4-inch plank, 2,696 sheeting piles, and 149 barrels of cement between 24 June and 24 July 1841, for example[9] - but it is impossible

to say precisely to what use each individual item was put. No doubt the forthcoming archaeological and engineering investigation of the locks will provide much information on the original construction of lock 1.

Maintenance, 1843-80

During the first 30 years of use little more than ordinary maintenance - trimming, grouting and pointing - seems to have been required on the lock. There were complaints in 1848 that the breast and chamber walls were leaking badly, a problem apparently rectified by repointing that fall. Few other repairs are mentioned in the records of the Department of Public Works again until 1867, when several stones in the upper sill were replaced with oak timber.[10]

By the mid-1870s lock 1 was in need of major repairs. Over the winter of 1874-75 a portion of one of the recess walls was taken down and rebuilt.[11] Three years later the department reported that damaged masonry in the south wall had been replaced with new stone and in the north wall with timber,[12] apparently in a patchwork manner.

Leaking behind the walls from the top of the lock was a serious problem, which by 1879 was found to have separated the facing of the west wall from the backing. That winter a "French drain" was dug to carry leakage to the rear of the bank. The bulged portion of the facing stone was forced back into place by means of "screw jacks secured there by iron bolts" and attached in back to posts, also presumably with bolts. A further measure to prevent leakage, a dry retaining wall, was built at the lower end of the lock[13] probably on the west side.

Rebuilding the Lock in Timber and Masonry, 1880-86

Despite these measures, seeping water remained a serious

threat to the stability of the entrance lock and necessitated major repairs and its almost complete reconstruction over the next few years as part of the canal rebuilding program of the 1880s. Over the winter of 1880-81 the face of a portion of the upper east wall, including the hollow quoin which had been forced inward 8 or 10 inches, was rebuilt "partly with cut stone and partly with timber and concrete." The puddle was renewed at the same time. No further details are given. Later photographs indicate that the timber tier at the lock head was taken right up to the level of the coping of the main chamber wall, rather than just to the water line as on the other locks (see Figs. 4 and 7). The edges of the timber were later covered with thin sheets of metal to protect them from damage by passing boats. A photo taken in 1923 shows the top of stones spaced directly behind the chamber walls at regular intervals on the east side, suggesting that the buttresses were left undisturbed in the reconstruction.[14]

Two years later the west wall of the lock was taken down and rebuilt, the lower portion "with a timber facing, sheeted with boiler plate at all projecting angles and a backing of masonry and concrete to a height of seven feet above the mitre sill," of which was also reconstructed.[15] At the upper end of this chamber wall at the gate, the timber (as seen in later photographs) was taken right up to the level of the coping of the chamber wall, above which were then placed seven layers of masonry to the level of the coping of the walls of lock 2. (This section acts as the lower wing wall of the second lock and provides the inner wall for the stone steps leading up to the next lock, as is true for the east wall. See Figs. 4 and 7.) How the timbers were secured to the backing is not stated, though the engineer had written that he intended to secure these

horizontal timbers with long bolts passing through the backing to be secured into upright binders at the rear.[16] Later photos show these bolts on the timber face.

Further work was done in the spring of 1886 when the lower wing wall on the west side was repaired by the replacement of 20 feet of coping stone with timber.[17] This arrangement must have proved satisfactory, however, for photographs in 1904 indicate that the timber had again been replaced by stone.

Precisely when the east chamber wall was rebuilt in timber and masonry is not recorded. It was probably during this period. The piecemeal rebuilding of the lock by the department certainly did not follow the detailed and orderly plan drawn up in 1882 by J.E. Doré (see Fig. 3) who, for example, had proposed replacement of the arched masonry floor with planking and the complete rebuilding of the lock. Nor did the work prove very successful. The minister reported in 1892 that the "enormous leakage" at the lock was interfering with the lockage above and that the lock probably required complete rebuilding, a difficult and expensive task because of its location at the basin.[18]

Repairs, 1893 to the Present

During December 1893, after an unsuccessful attempt the preceding May, the lock was pumped completely dry, the first time since its construction, to ascertain its condition and to make repairs. Missing portions of the lower oak mitre sill were replaced by pieces of hardwood ragbolted to the sill and the recess floor was replanked. Some broken coping stones were replaced and the anchors at the lower gates on the west side were made more secure with bolts laid with lead and "brimstone" into the hollow quoins.[19] The general condition of the lock from the lower recess down was found

to be so dilapidated that it required rebuilding.

In fact, there was no rebuilding and work was confined in the spring of 1897 to securing the coping on the east wing wall to the course below with iron straps and long bolts made fast to a heavy piece of oak at the rear of a retaining wall 20 feet behind the face of the lock. By a similar arrangement of straps and rods the facing stones were reconnected with the backing and the voids filled up, presumably with concrete, though the material is not stated.[20] Two years later the west wing wall was put back into position by use of similar iron bands and rods secured at the back to a heavy block of concrete fixed in the ground some distance behind the lock.[21]

A considerable amount of work was done on the lower lock during the fall and winter of 1901-02 when it was dammed and drained. The "round wall" at the lower end of the lock which had been carried away by ice and flood the previous year was reported to have been rebuilt, though precisely what wall is meant is not clear. At the same time the wing and chamber walls were repuddled. The lower mitre sill, patched almost a decade earlier and now leaking badly, was replaced by a new sill, also made of oak and bedded in concrete. Construction of the new mitre sill was described in detail in the canal superintendent's report for 1902.

> Removing the sill to replace it by a new one in oak 15" x 16" with three braces inside, one 28" by 15" and the two others 14" x 15". Nailing sill with 7 solid old bolts with nuts, and twelve long screws 30" long x 1-1/2" thick. Three iron double squares on different parts of the sill. Filling inside with concrete 4 Barrells Cement 6 Barrells of [illegible, perhaps sand] and 8 Barrells of stone. Flaring between mud sill and mitre sill 18' x 26' with planks 1-1/2"

> tongued and grooved and the same below the sill 5' x 24'4", Laying two iron plates 4" wide by two feet long over the sharp ends of the sill and two inches under the wall inside....Replacing the five feet long cut in mud-sill 15" x 12".[22]

The planking between and below the sills was replaced.

Little further attention was given to the lock until the 1920s, when, over a period of several years portions of the east and west walls and the hollow quoins were faced with steel plates.[23] The mitre sills were "renewed", partly in wood and partly in concrete, in 1929. Then in the spring of 1937 a 12-inch layer of reinforced concrete was laid over the wooden apron at the lower entrance to the lock. It was also reported that year that the concrete wall at the northeastern corner of the lock entrance had been rebuilt,[24] though the wall to which the report refers is unclear.

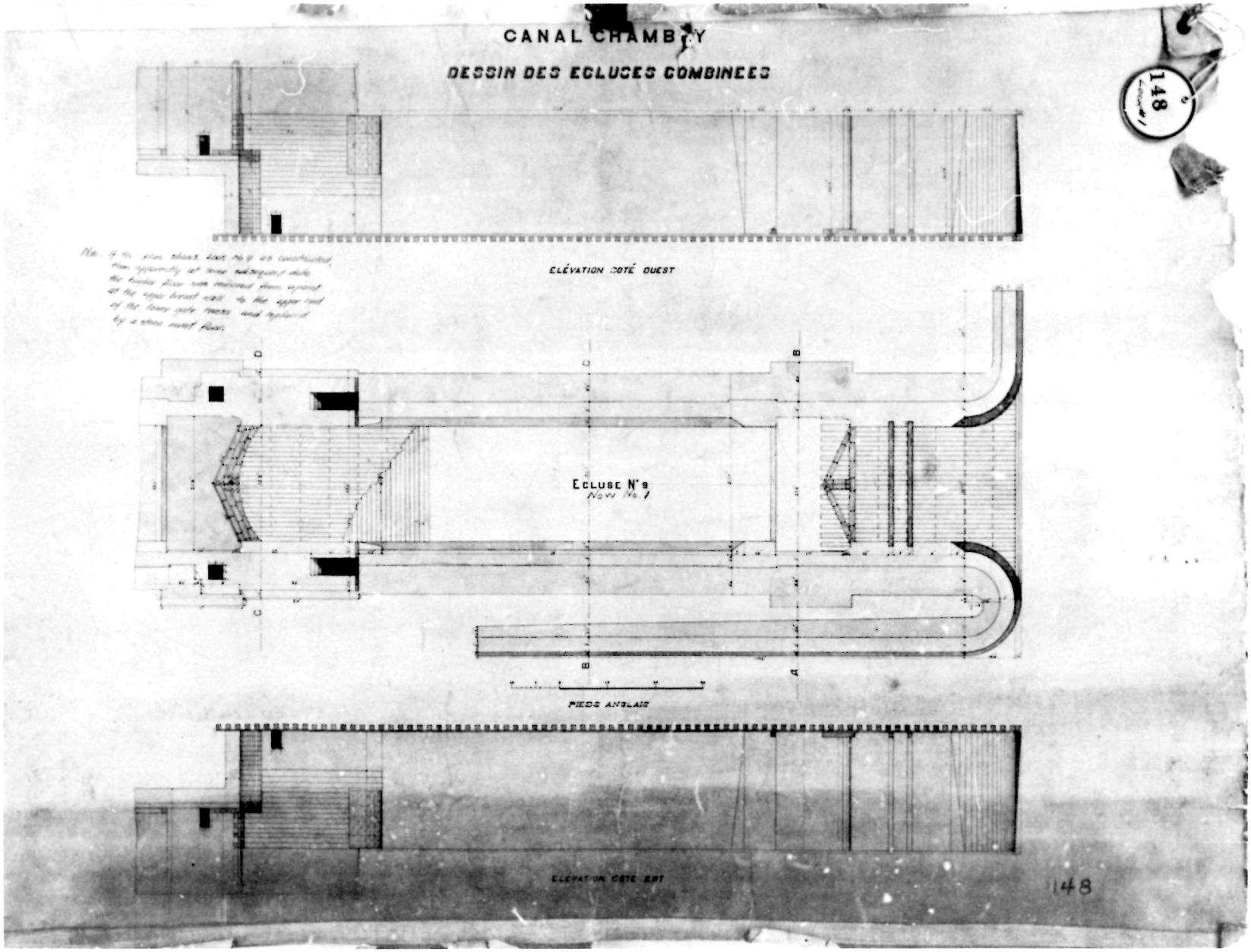
Since the 1930s, few changes seem to have been made to the lock structure. The walls and breast walls were regrouted in 1950-51 to stop the serious leaks which were undermining the lock. Over the winter of 1953-54 the top of the upper breast wall and mitre sill was replaced with a layer of concrete 7 to 24 inches thick (Fig. 7).[25] At some time after 1954 (though it seems not to have been recorded) the chamber and wing walls were covered with a thin layer of concrete, most of which (on the timber portions in particular) has fallen off (see Figs. 7 and 8). During the winter of 1973-74, sheets of plywood were placed on the walls from below the upper east gate to protect both them and boats from damage.

The Lock Today

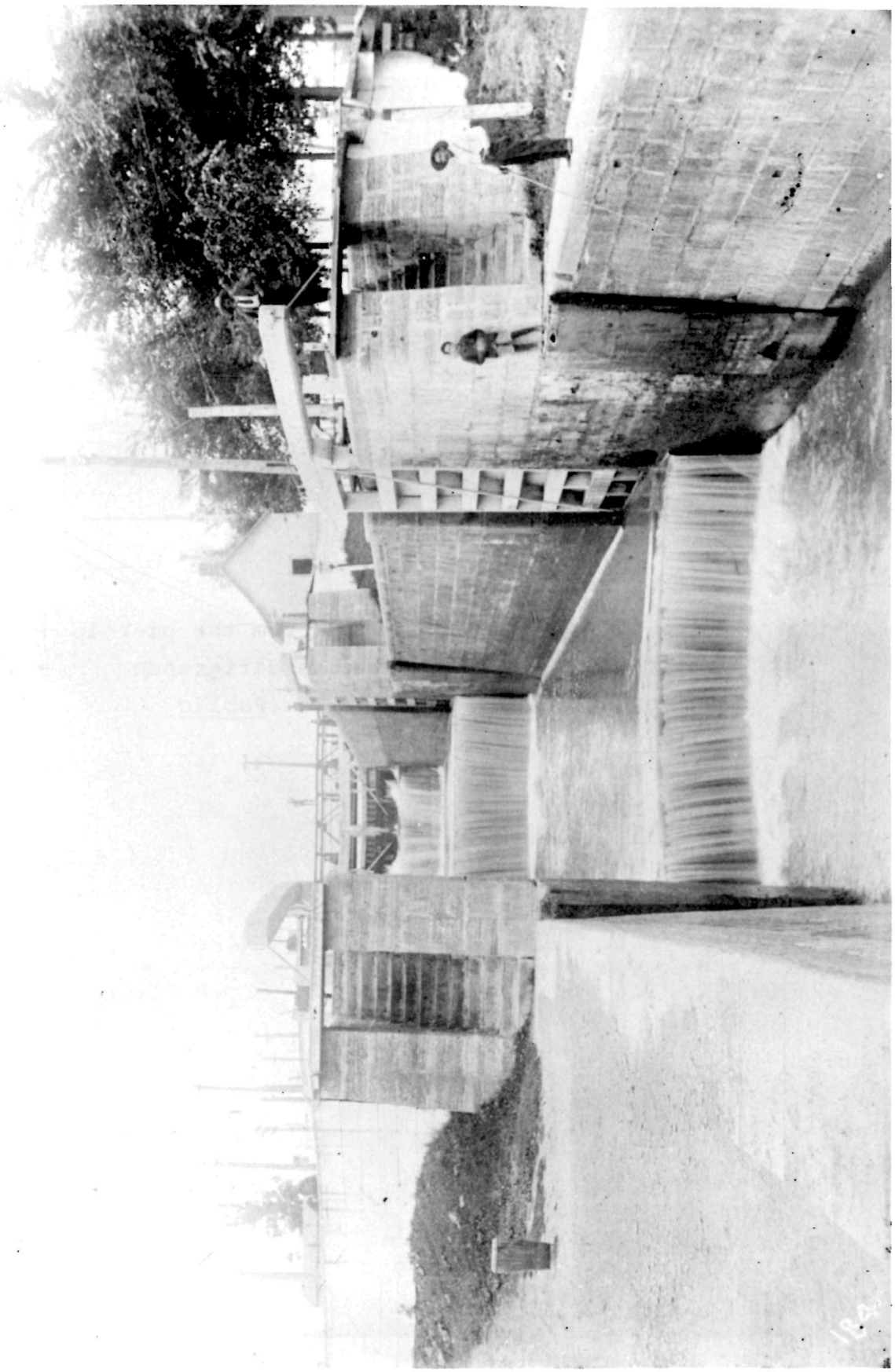
Today the basic lock structure remains little changed from its appearance at the turn of the century. The floor is the

original masonry arch constructed when the lock was built, while the walls remain basically as they were rebuilt in the last two decades of the 19th century. Only the concrete sill and lower apron and the now crumbling facing have been major changes since that era.

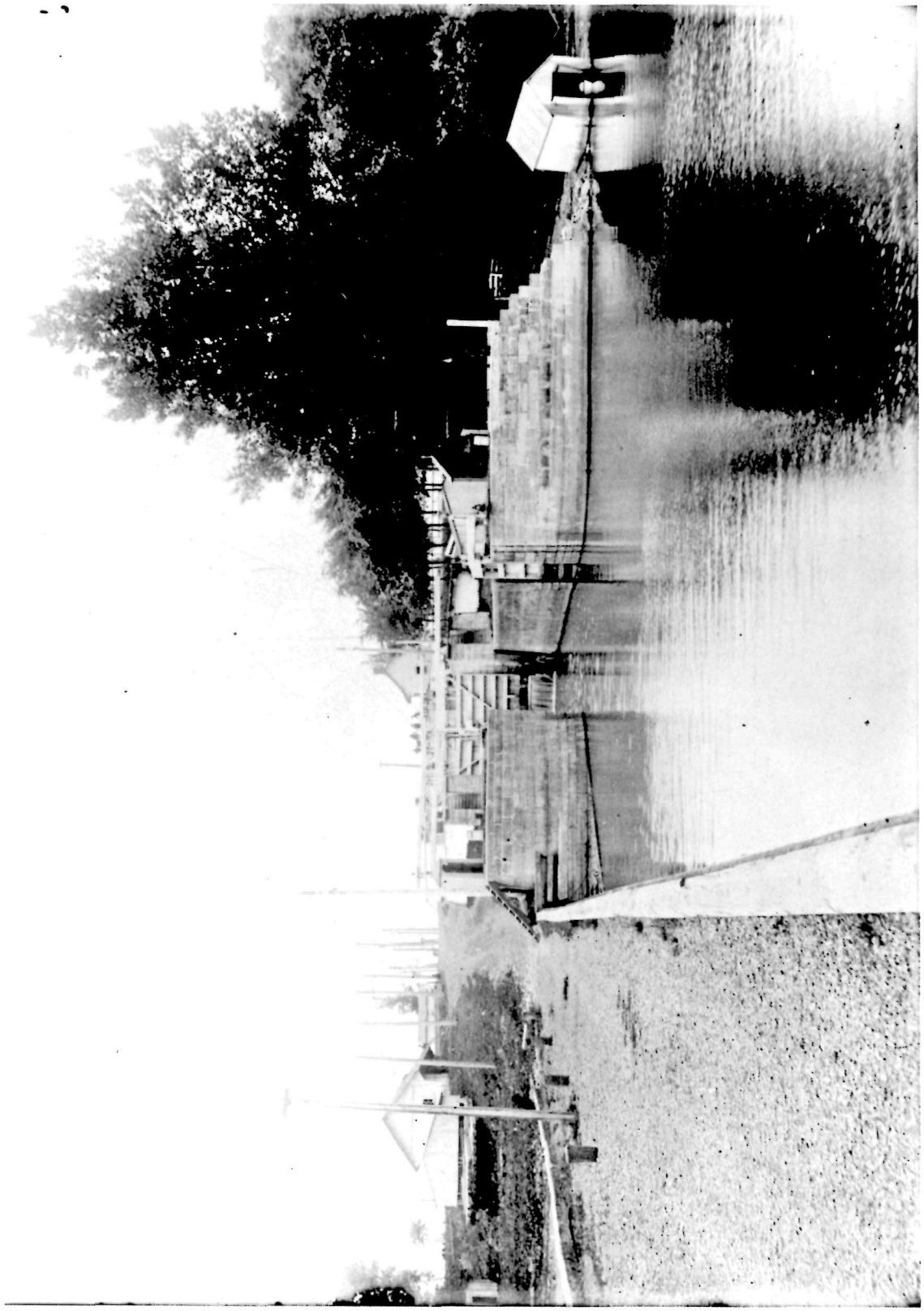
3 J.E. Doré's plan for the reconstruction of lock 1, ca. 1882. Note that the plan included the replacement of the inverted masonry arch floor with planking and of the masonry breast wall with timbers. Neither proposal was implemented. Note also the retaining wall extending upward from the lower east wing wall, parallel to the east chamber wall. (Quebec Canal Office, Parks Canada, Montreal.)


CANAL CHAMBLY
DESSIN DES ECLUSES COMBINEES
148
ELÉVATION CÔTÉ OUEST
ECLUSE N° 9
Now No. 7
PIEDS ANGLAIS
ELEVATION CÔTÉ EST
148

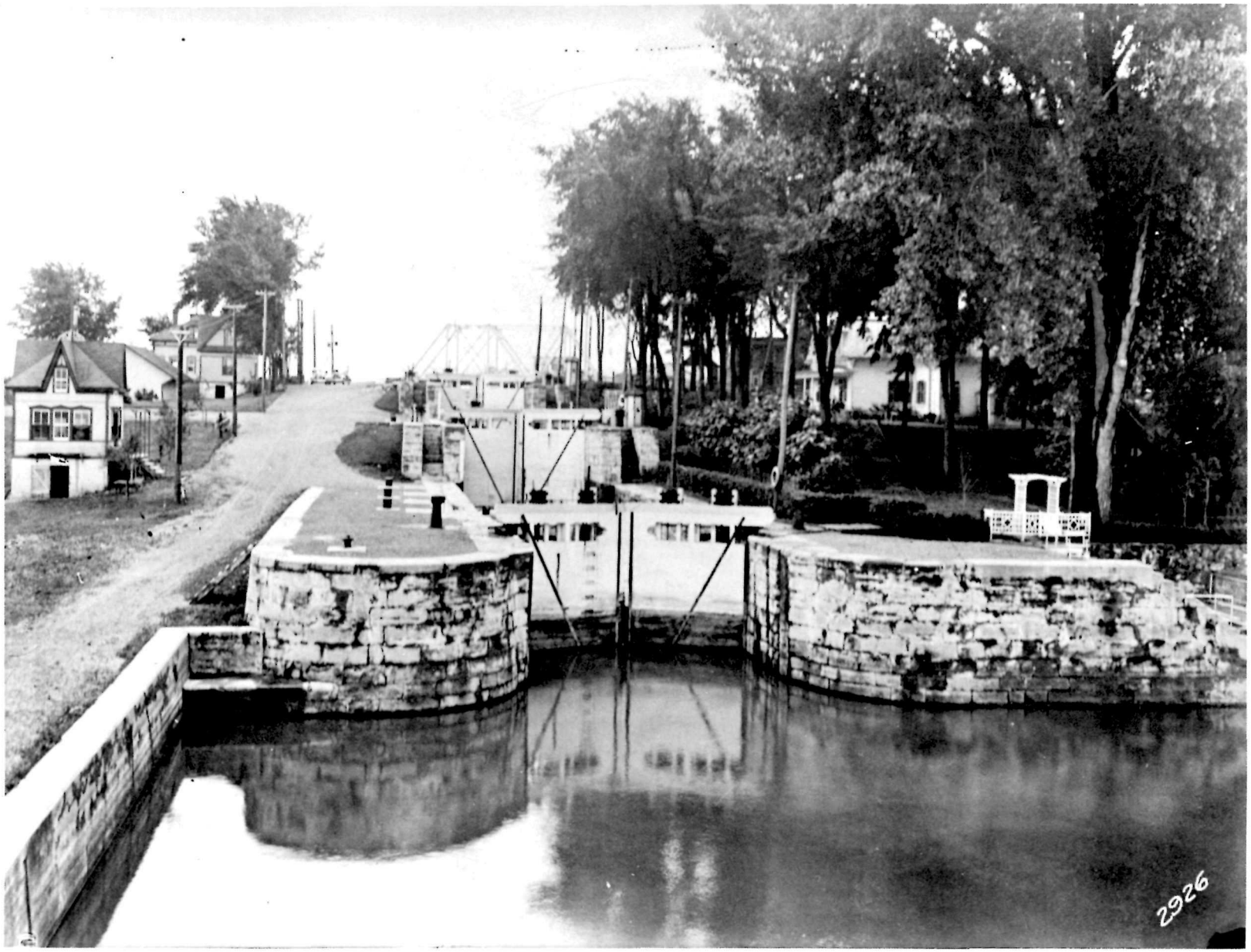
4 Looking up the flight of locks from lock 1, 1904. Note the cat-walks across the stairwells to allow for the operation of the gates. (Public Archives of Canada.)



5 A view of the combined locks from the pier in Chambly Basin, 1904. Note the difference between the lower wing walls. (Public Archives of Canada.)

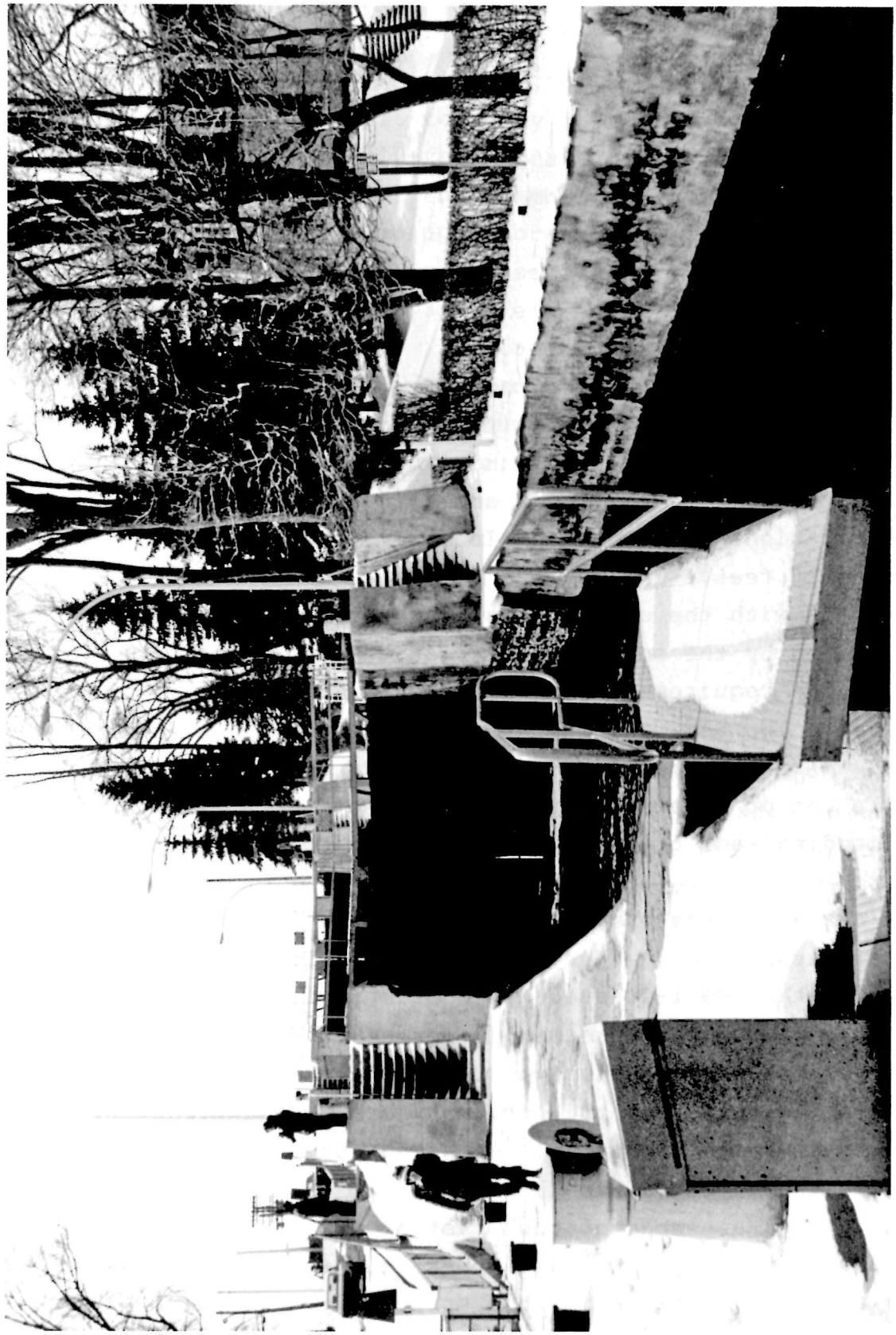


6 A view of the combined locks, 1943. (Public Archives of Canada.)


2926

7 The west wall of lock 1 during repairs, 1954. Note the renewal in concrete of the recess floor, sill and breast wall shared with lock 2. Note also the timbers at the lock head and the decaying masonry at the lower gate. (Public Archives of Canada.)

8 Lock 1, 1973. Note the cement facing on the chamber walls and stairwells, the steel walkways (foreground), and the new electrical system for the operation of the gates beside the earlier winches (left foreground).



Lock 2

The Specifications, 1840

According to the specifications for the combined locks,[1] the middle lock, the second in a flight of three, was to be 24 feet wide between the piers and 120 feet long (see App. E, part B. Unfortunately the plans referred to in the specifications have not been located.) It was to have a lift of 10 feet 6 inches, and 6 feet of water on the mitre sills. As with the other locks, the foundation was to be determined by the engineer on the site, based upon the particular requirements of the ground, the nature of which had yet to be ascertained. The choice for the bottom of the lock was to be between an inverted masonry arch laid over a rubble bed or a foundation consisting of well-puddled longitudinal and transverse timbers covered with a plank floor.

Also like the other two locks, the walls were to be of ashlar masonry at the face, "bedded fully with water lime," topped with a well-dressed layer of masonry coping and backed with rubble stone set in mortar and grouted with hot lime. Width of the walls was to be 8 feet at the bottom tapering to 5 feet at the top. Supporting the structure were to be 5 counterforts on each side of the chamber between the recesses. An 18-inch layer of fine quality puddling and an embankment consisting of the material excavated from the lock pit, top-soiled and sodded, were to complete the job of making the structure stable and watertight.

Wall sluices, 4 feet by 2 feet, of ashlar masonry laid in cement, were to be built to carry the water supply in and out of the lock past the 12-foot breast walls and gates at the upper and lower ends of the chamber shared with the locks above and below. The upper breast wall arch and mitre sill of lock 2 (which was also to serve as the lower breast wall and mitre sill of lock 3 above) was to be of ashlar masonry supported by piles. The lower breast wall and mitre sill of lock 2 over which the lower gates were to hang, were to serve also, of course, as the upper breast wall and mitre sill of lock 1 below. (See above, "Lock 1".) Also because of the position of this middle lock in the flight, no wing walls as such were to be required, though this is not clearly spelled out in the specifications.

Construction, 1840-42

The clearing of the site and excavation of the middle lockpit were begun in August 1840 but were hampered by the decision to change the location of the lower entrance to the canal and by other difficulties with the work on the first lock. The excavation was consequently not completed until mid-December 1841,[2] by which time the agreed time of completion of the lock by the contractors (Lauder, Whitlaw and Tennant) had already passed.

The laying of the masonry, obtained from the Chambly and Montreal areas and from the Champlain Quarry in Vermont, was begun in the spring of 1842. By 1 June, the walls had been raised 6 feet and by the end of August the job, with the exception of the coping, was finished. Late that fall the engineer, George Keefer, announced that the lock, complete with the gates, was ready for the reception of traffic in the spring.[3]

The Lock as Built, 1842

The evidence available indicates that lock 2 was built with close reference to the terms of the specifications, though with some modifications to meet the nature of the ground and to economize on the money and time required to build it (see App. F). The lift of the lock was changed from the proposed 10 feet 6 inches to 9 feet 9 inches, thus necessitating a corresponding reduction in the height of the masonry breast wall arch on which the masonry upper mitre sill was to rest. Length of the lock was extended to 125 feet 11 inches.

The solidity of the slate rock base of the lockpit, while making excavation a more onerous job than anticipated, also allowed Keefer to cut down drastically on the number of piles under the foundation of this middle lock. It also persuaded Keefer to order a reduction in the thickness of the rubble backing in the walls. Yet the reduction must not have been drastic, since the walls of lock 2, when dismantled in 1891, were said to be 8 feet thick, the same figure set out in the specifications for the bottom width.[4] At the same time the irregularity of the slate necessitated the pouring of concrete into the depressions to provide a level base for the timber foundations.

On the base of slate and concrete the contractors placed longitudinal rows of hemlock flattened on two sides for stability. Over this layer was placed a row of timber, sawed 11 inches square, across the width of the lock. Again concrete seems to have been used to fill in the gaps between the timbers.

Over the timber and concrete foundation was laid the inverted masonry arch which even today forms the floor of the lock. (The only exception was the lower recess floor which was probably a 4-inch plank.) Whether the arch rests upon a rubble bed as called for in the specifications or

simply upon poured concrete is unclear from the information available.[5]

Stone steps,[6] although not called for in the specifications, were built on the outer face of the walls at the gates to allow pedestrians to climb up from the level of lock 1 to lock 2 and from lock 2 to lock 3. As with lock 1 these steps proved a serious obstacle to the lockmen in the process of pushing the balance beams to open and close the gates. Planked walkways were placed across the stairwells to rectify the difficulty (Fig. 10).

Unfortunately the nature of such engineers' and contractors' records as have been located makes it impossible to determine what other adaptations may have been made during construction of lock 2. The contractor's monthly estimates do give the total quantities of materials used in the combined locks, but one cannot state with any certainty to what use each individual item was put. The departmental report at the time of confederation[7] adds a few more details to the total picture: the embankment was 15 feet wide with an outside slope of two to one, and the width of the lock was 23 feet 9 inches. The forthcoming archaeological and engineering investigation of the locks will, no doubt, provide many answers to such questions.

Maintenance, 1843-81

Despite George Keefer's confidence at the time of construction that the work on the locks had been well executed, there were reports within five years that the breast and chamber walls of lock 2, like those of the other two locks, were leaking badly. That fall the walls were repointed in an attempt to solve the problem.[8] Fender timbers were placed on the upper and lower wing walls about 1850 to absorb the shock from boats hitting the wall and

thus lessen damage to the masonry.

Little significant repair work seems to have been done again on the lock until 1858, when some of the broken stones in the floor and in the mitre sills were replaced and bolted in place.[9] Nine years later one of the sills was "renewed", apparently by the same method.[10] Still further repairs to the sills were required and executed in the following decade.

Rebuilding the Lock in Timber and Masonry, 1882-98

The neglect of the proper maintenance on the canal meant that by the late 1870s, lock 2, like the other locks in the system, was in a hazardous condition. In 1879 it was reported that the "west wing wall" (the lock head below the upper gate) was in danger of collapse.[11]

The problems of lock 2 were tackled during the winter of 1882-83. The unstable walls at the gates and the stairs were dismantled. The lower portions of the former were rebuilt with a timber facing for a distance of 7 feet above the mitre sill (bringing them to the level of the main chamber wall) and backed with masonry and concrete. Cut-stone masonry, salvaged from the original, was laid above the timber work. All projecting angles were sheeted with boiler plate. The steps were rebuilt in masonry. At the same time, the masonry breast wall and mitre sill between locks 1 and 2 were reconstructed.[12]

By the end of the decade it was recognized that more major work was required on the lock. Over the winter of 1890-91 the entire east chamber wall, from the lower recess shared with lock 1 up to and including part of the east wall of lock 3, was taken down to the foundations for a length of 158 feet. In keeping with the departmental rebuilding program for the canal system, the east wall was rebuilt

partly in stone and partly in timber. The face of the lower timber portion consisted of eight rows of square pine timber, 9 feet 4 inches high, backed with 8 rows of plank, all held together with iron bolts. Behind the timber was a masonry backing. The whole mass was bound together with numerous bars of 1-inch iron 8 to 12 feet long, secured with strong nuts to blocks of oak placed in the rear of the masonry. The timber portion of the wall below the gate containing the stairs was again reconstructed (the first time was in 1882-83) and, with the rest of the wall, was braced solidly with iron bars (Fig. 10). Also dismantled with the east wall were the sluice culverts. These were rebuilt, "en gros blocs d'épinette rouge de la même hauteur que le mur principal," according to the canal superintendent. Precisely what he meant by this description is, however, unclear.

The upper portion of the east wall above the timber was reconstructed with five rows of masonry laid in cement and topped with a row of coping. The superintendent in his report for 1891 assured the Department of Railways and Canals that it was all first-class work.[13] (For a list of materials used see App. G.)

The department continued its rebuilding of lock 2 the next year, 1891-92, when the entire west wall was dismantled and rebuilt, apparently in similar fashion to the east wall, though the superintendent omitted to record the work in any detail. (See Figs. 11 and 12; for a list of materials used see App. G.) There were some obvious differences between the walls, however. A 1954 photograph shows, for example, that the west abutment wall above the lower gate recess, at least, does not consist of timber to the waterline but rather of four courses of masonry at the bottom with three rows of timber above. Above that were five courses of masonry and one of coping (Fig. 7).

The old problem of leakage continued to plague the workings of lock 2. Over the winter of 1896-97, the masonry mitre sill between locks 2 and 3 was rebuilt and the lower sill shared with lock 1 was regrouted. The lock was now deemed watertight.[14]

Then within a year it was reported that the upper east abutment wall between locks 2 and 3 had been moved inward by the action of the frost. The masonry portion of the wall, comprising the upper 9 feet, was taken down. The timber, found to be in good condition, was left in place and planed to bring it in line with the face of the lock chamber wall. Bolts were driven through the timber to the back of the rubble masonry and firmly anchored in the rear to vertical tamarack posts. The cut-stone masonry above was then set back in place.[15]

Repairs, 1914 to the Present

After the major work on the lock during the 1880s and 1890s, little repair was necessary until the World War I period. Since then the primary repair material for lock 2 has been concrete. Over the winter of 1914-15 a leak in the west chamber wall was stopped by removing part of the old masonry in the rear and replacing it with concrete. That same year the upper sill was replaced with concrete, as was the lower sill in 1929. Steel plates were installed in the hollow quoins in 1931. Later, in 1947-48, a leak through the embankment behind the lower west machinery pit was blocked with sheeting, though of what sort is not stated. Part of the pit was then rebuilt in concrete. Several years later, in 1953-54, the top 24 inches of the breast wall between locks 1 and 2, tapering to a thickness of 7 inches in the gate recess, was replaced with concrete.[16] Sometime since then the lock walls have been coated with a thin veneer of

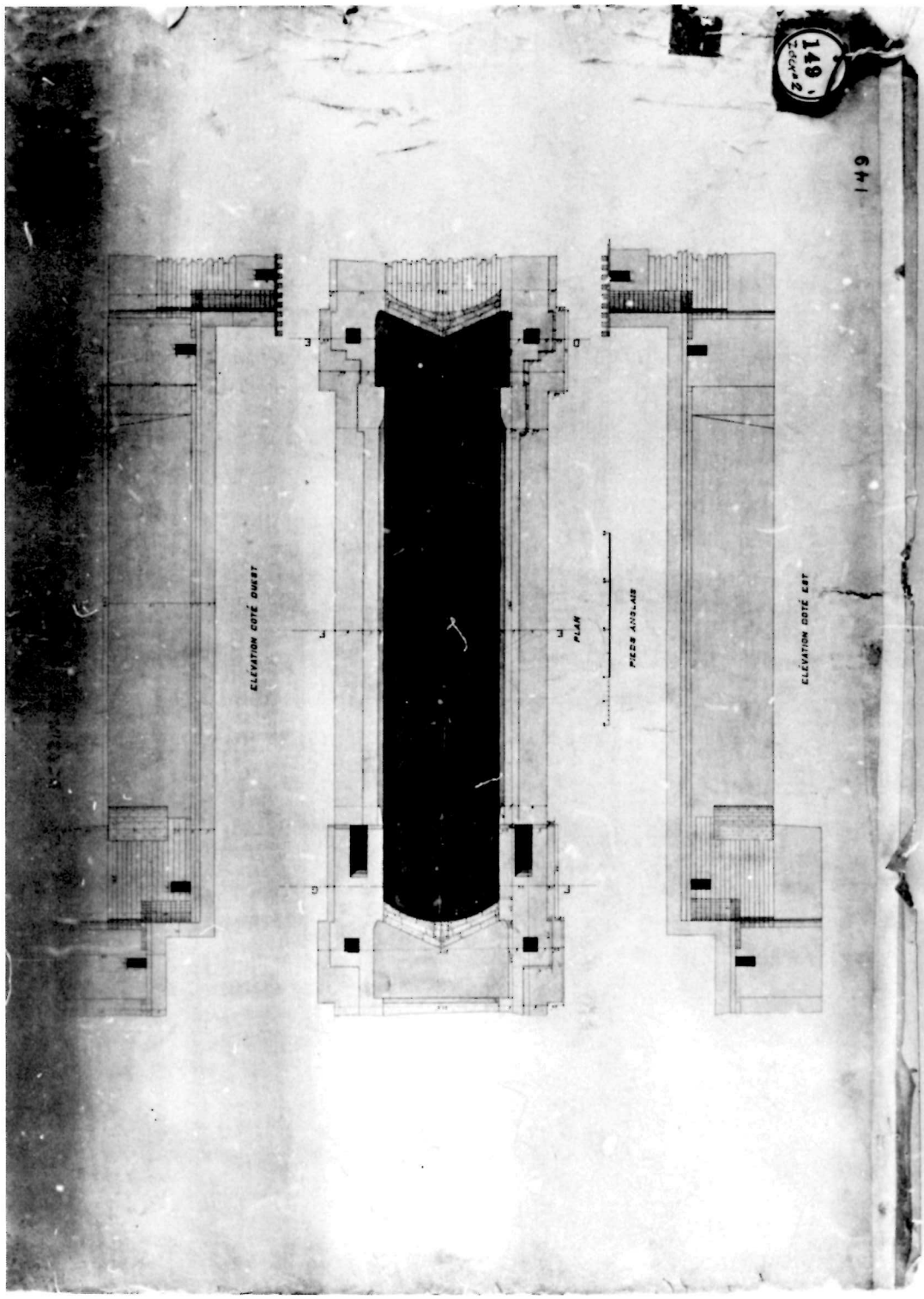
concrete, most of which has crumbled off the lower timber portion of the chamber (Fig. 12).

During the spring of 1974, sheets of plywood were placed on the east wall below the upper gates to protect vessels and the wall from damage.

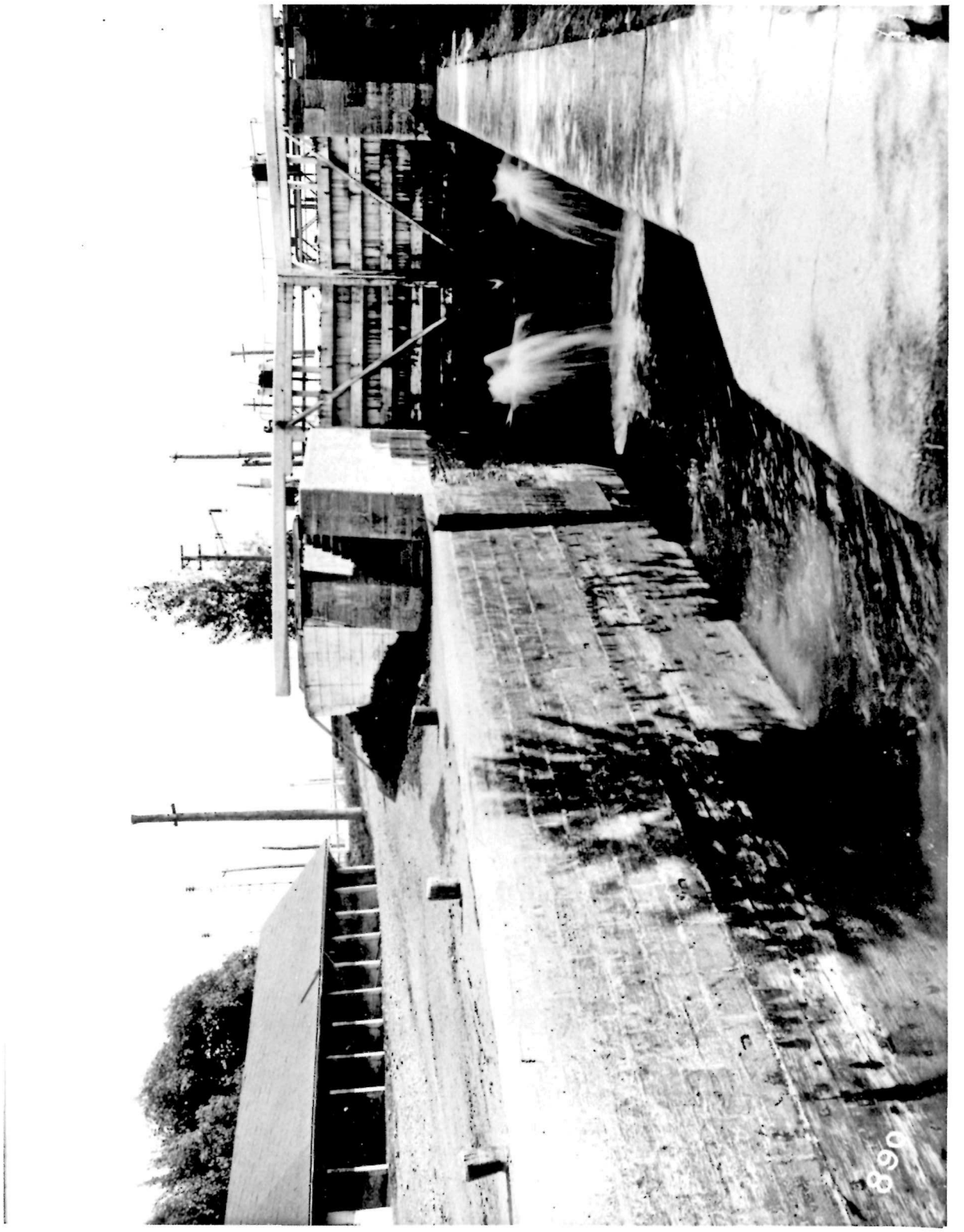
The Lock Today

Today the basic lock structure varies little from the lock as rebuilt in timber and masonry in the latter part of the 19th century. The arched masonry floor is the original bottom of the lock. The major deviations from its 19th-century appearance are the concrete sills, breast walls and recess floors, as well as the now crumbling concrete facing.

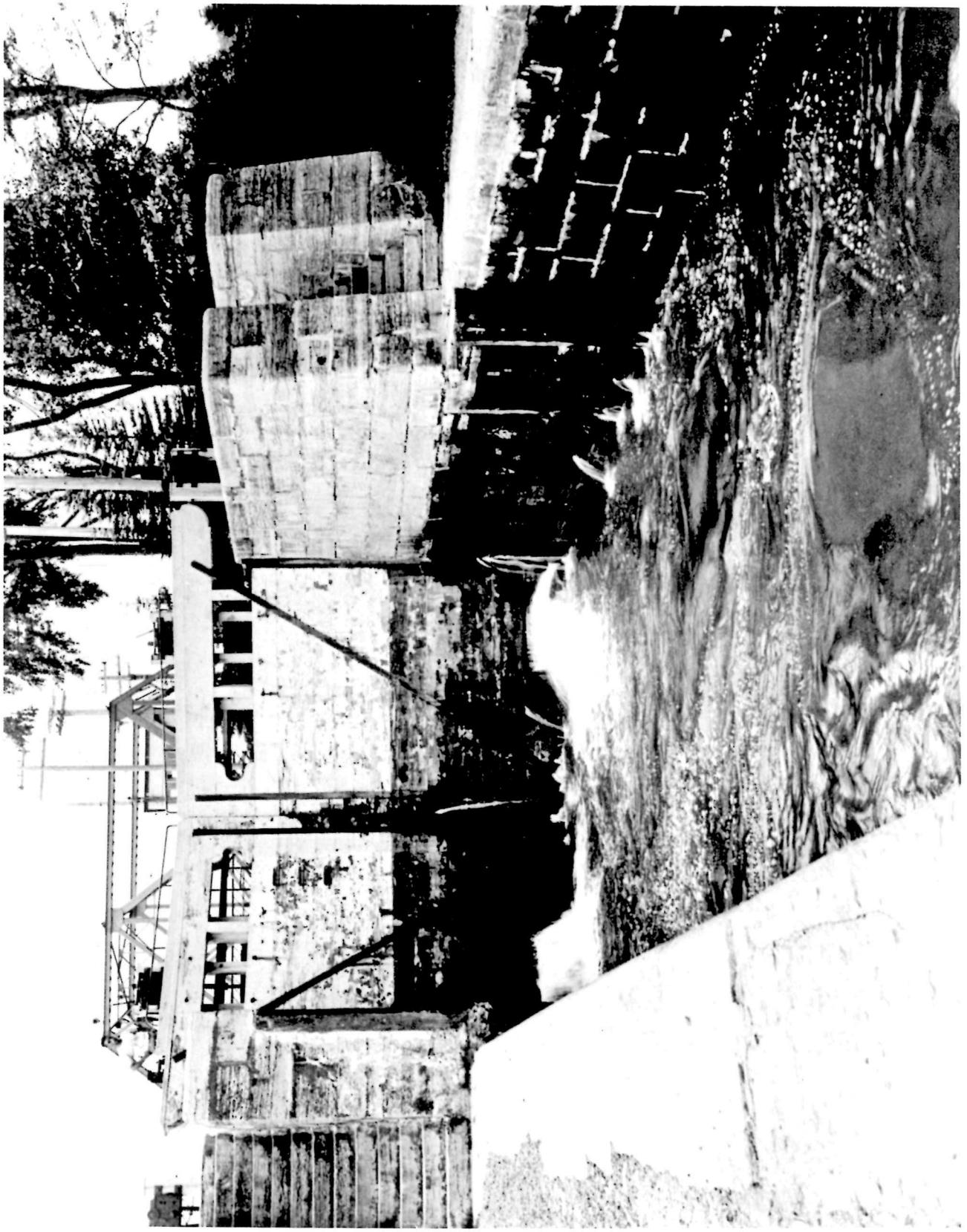
9 J.E. Doré's plan, ca. 1882, for the reconstruction of lock 2. (Quebec Canal Office, Parks Canada, Montreal.)


149
ELÉVATION CÔTÉ OUEST
PLAN
PIERS AVIGNON
ELÉVATION CÔTÉ EST

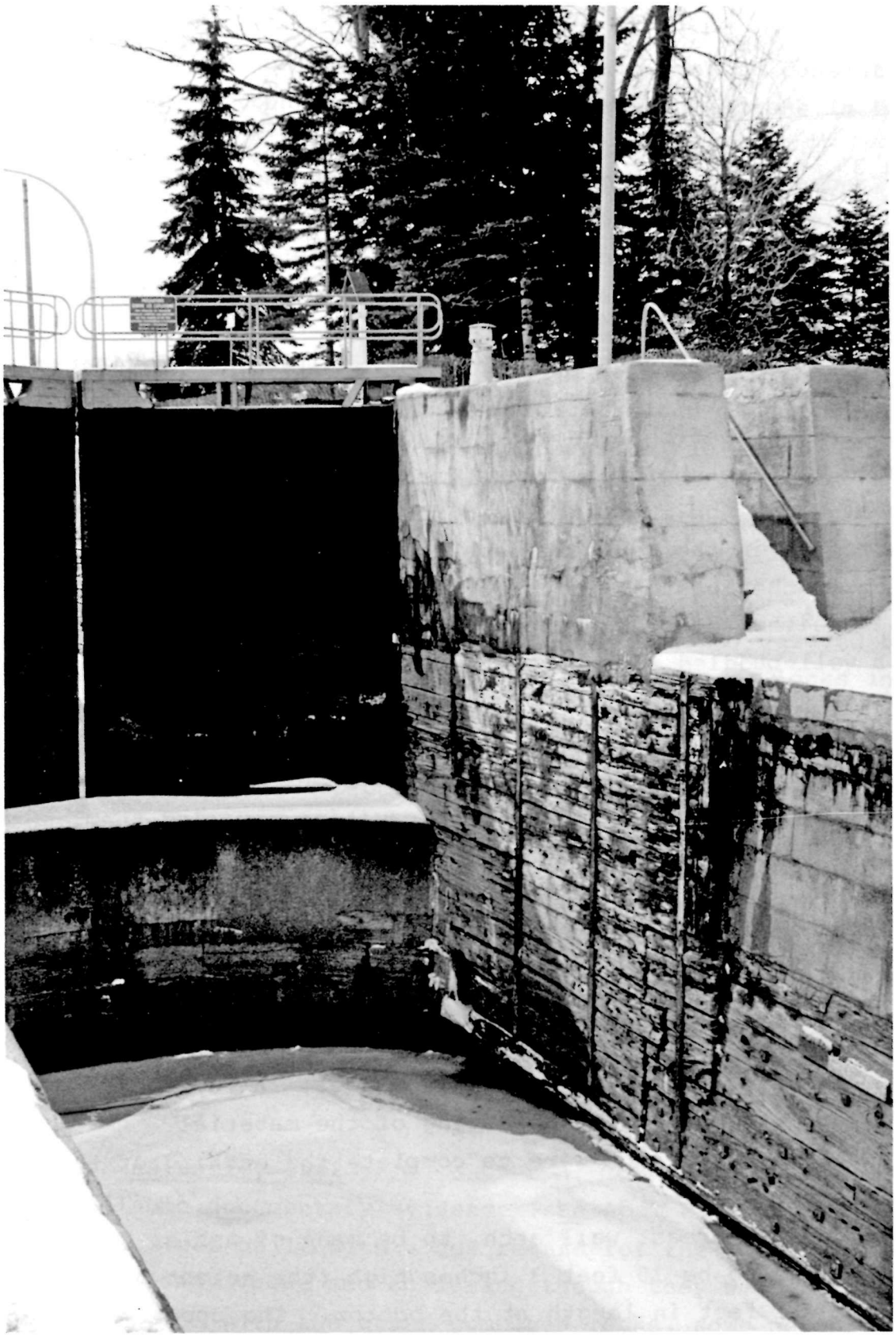
10 The upper east wall of lock 2 in 1911. Note the cat-walk and platform for operating the gates, the timbers on the chamber wall and at the head of the lock, sheeted at projecting corners with metal. (Public Archives of Canada.)



11 The upper west wall of lock 2 in 1954. Note the timbers held by iron bars at the head of the lock. (Public Archives of Canada.)



12 The upper west wall of lock 2 in 1973. Note the concrete facing on the masonry and the "renewal" of the breast wall and mitre sill with that material. (Public Archives of Canada.)



Lock 3

The Specifications, 1840

The specifications[1] accepted by Lauder,Whitlaw and Tennant for the upper lock in the Chambly flight called for a lock measuring 24 feet between the piers, 120 feet from the pointed sill to the breastworks, and a lift of 10 feet 3 inches. (See App. D, part B. Unfortunately the plans referred to in the contract have not been located.) The bottom of the lock, as in the others in the series, was to consist either of rubble supporting an inverted masonry arch or of well-puddled timber covered with jointed planks. Supporting piles were to be used in either case as required. The necessary decisions were to be made by the superintending engineer based upon his assessment of the particular needs of the sites as excavation revealed them.

The walls of the lock were to consist of ashlar masonry "bedded fully in water lime" and backed by stone rubble set in mortar and "well grouted with hot lime grout." Width of the wall at the base was to be 8 feet tapering to 5 feet at the top course, over which a row of coping 3 feet in breadth was to be set. The chamber walls were to be supported by five masonry counterforts 4 feet by 4 feet. A layer of puddle and an embankment consisting of the material excavated from the lock were to complete the backing of the lock walls.

The upper breast wall arch, to be made of ashlar masonry, was to be 10 feet 3 inches high (the height of the lift) and 12 feet in length at the bottom. The upper mitre

sill, built as a unit with the breast wall, was to consist of a course of stone 18 inches deep with the keystone in the centre cut in one piece.

The water for the lock was to enter into the chamber, not through sluices in the gates as in the locks built in the 1830s, but rather through sluices built in masonry through the walls from the upper gate recess, past the breast wall and into the chamber just below the upper gate. Size of the opening at the face was to be 4 by 2 feet.[2]

No mention was made in the specifications of the upper wing walls or for placement of stop logs to facilitate the draining of the lock.

Construction, 1840-42

Excavation of the upper lock pit and upper basin, delayed by slow progress in the construction of the two lower locks in the flight, was not completed until the spring of 1842. This done, the progress of building the foundations and laying the masonry of lock 3 proceeded rapidly. The best stone was procured from the Champlain Quarry 6 miles south of the United States border; it was imported in a rough state and dressed on the site by the contractors.[3] All but three courses were laid by the end of July and, with the exception of the coping, were set in place the next month. All work on lock 3, as on the other combined locks, was completed by November 1842.[4]

The Lock as Built, 1842

The available documentary evidence (see App. F) indicates that lock 3 was built with a due regard for the specifications, vague and confusing though they were. But there were, as with the other combined locks, some notable

modifications. The lift of the lock, for example, was changed from the proposed 10 feet 3 inches to 9 feet 3 inches and the length to 126 feet. The width of the lock was reported in 1868 as 23 feet 9 inches,[5] though the lock may well have been the full 24 feet when completed.

Although the strength of the slate bedrock allowed Keefer to reduce drastically the overall number of piles needed to keep the combined locks from settling, it is probable that a large number would nevertheless have been required to support lock 3, particularly the wing walls at the upper entrance which were built on a clay instead of a rock foundation.[6] (Rather than being cut its full depth out of ground with the ground level forming the sides of the channel, the Chambly Canal was formed by embanking the sides, thus minimizing the amount of cutting required. As a result the bottom of the upper wing walls of lock 3 rest almost at original ground level which consists of clay rather than of rock.)

Like the other two locks in the flight, the upper lock was built upon a foundation of timber placed the length and width of the lock, with concrete filling the spaces between. The floor of the chamber consisted of masonry, forming, with the walls, an inverted arch (Fig. 13). Whether there is any rubble beneath, as called for in the specifications, is as yet unknown.

Keefer ordered a reduction in the thickness of the rubble backing in the walls, though if lock 3 were like lock 2, whose walls were found in 1891 to be about 8 feet thick (the same as called for in the original specifications), the difference must not have been large. The coping and the breast wall masonry were held in place with bolts leaded into holes drilled in the masonry. Although not called for in the specifications, the upper wing walls were built with vertical recesses in the masonry face for the reception of

oak stop logs to prevent the flow of water into the lock if necessary. Between the stop-log recesses at the bottom of the canal was a sill resting on and protected by sheet piling.

Maintenance and Repairs, 1842-81

Although an extra amount of puddle had been put at the top of lock 3 in an attempt to prevent seepage of water from the higher level down behind all the walls of the combined locks, it was reported in 1848 tht already the chamber and breast walls were leaking badly. That fall some of the stones were reset and clamped.[7]

Few repairs of note were again required - or at least done - on the upper lock until 1858, when some broken stones were replaced and some of the arched coping (presumably on the wing walls) was relaid in cement and braced with bolts. At the same time the upper breast wall and the mitre sills were grouted and bolted in place with 51-inch fox wedge bolts[8](see App. J).

Within a few years, the upper wing and recess walls, described in 1861 as in an "insecure state," required more than a few repairs. Yet it was not until the spring of 1864 that the department rebuilt portions of the recess walls, as well as the breast wall. The next year a new mitre sill was constructed, partly in oak timber and partly in stone.[9] Whether the required rebuilding was done to make the wing walls secure is not recorded in the annual reports. It is unlikely, given the lack of written evidence and the general canals policy of neglect.

During the 1870s the maintenance of lock 3, like that of the other locks, was minimal, due to the general assumption that the canal was to be replaced or enlarged. Work on the lock seems to have been confined to repairs to

the mitre sill in 1869-70 and repointing of the walls several years later.[10] Then in 1879 the lock, with the rest of the system, received more serious attention, when the masonry was relaid, trimmed, grouted and pointed where required.

Rebuilding the Lock in Timber and Masonry, 1882-92

The problems at the lower end of the lock where it joined with lock 2 were tackled during the winter of 1882-83. The unstable walls at the gates were taken down and rebuilt with a timber facing and a masonry and concrete backing from the bottom of the lock to a height of 7 feet above the mitre sill to the level of the main chamber wall. Masonry salvaged during the operation was placed above. The contiguous stone stairs were rebuilt at the same time and the mitre sill between locks 2 and 3 repaired.[11]

Yet the basic problem - the fact that water was flowing freely behind the upper wing walls and had separated the facing stones from the rubble backing the whole length of the lock as well as the locks below - remained untouched. It was not until the winter of 1884-85 that the Department of Railways and Canals attacked that problem by building a trench behind the wall and replacing the washed-away puddle.[12]

It was obvious that the renewal of the puddle was not sufficient in any way to confront the basic structural instability of the lock. In the following winter, 1885-86, the walls on both sides of the lock at the upper entrance were rebuilt (though precisely where and for what distance is not recorded) in timber with a concrete backing to a height of 10 feet, and in ashlar masonry set in cement mortar above. At the same time the mitre sill and breast wall were rebuilt in wood and stone, though no details are given.[13]

Over the winters of 1890-91 and 1891-92 the work of rebuilding the lock in the timber-masonry style was completed. During the first year, in conjunction with the work on lock 2, the recess, abutment and part of the chamber wall (including the sluice) on the east side were taken down to the foundations. The wall was rebuilt with eight rows of jointed square timber at the bottom backed by eight rows of thick plank ("de pruche") secured to each other with iron bolts ("Chevilles de fer barbelé").[14] Behind the timber and planks remained the original masonry or rubble backing. The whole mass of timber, to a height of 9 feet 4 inches, was held together with numerous bars of 1-1/4 inch iron, 8 to 12 feet long, secured with nuts to blocks of oak placed at the back of the masonry wall and buttresses. Courses of masonry laid in mortar were placed above. It was reported at the same time that the lower east sluice culvert was rebuilt "en gros blocs d'épinette rouge." In 1891-92 a similar job of construction was done on the recess, abutment and chamber walls on the west side of the lock and on the rest of each chamber wall not already rebuilt.[15] (See Fig. 14.) During the required dismantling the sluice culverts, which were broken in places, were replaced by "un fort couverture en épinette rouge ainsi la partie supérieure de puits en pierre de taille." In addition one of the upper sluices, which had been losing a great deal of water, was repaired, grouted and puddled. The bottom of the lock behind the lower sill, which had risen, was cemented again to prevent leakage through the sill. As was the case with locks 1 and 2, the piecemeal rebuilding of lock 3 does not appear to have followed the plan drawn up about 1882 by J.E. Doré (see Fig. 13).

Maintenance, 1893 to the Present

Concrete has been the primary material for repairs and

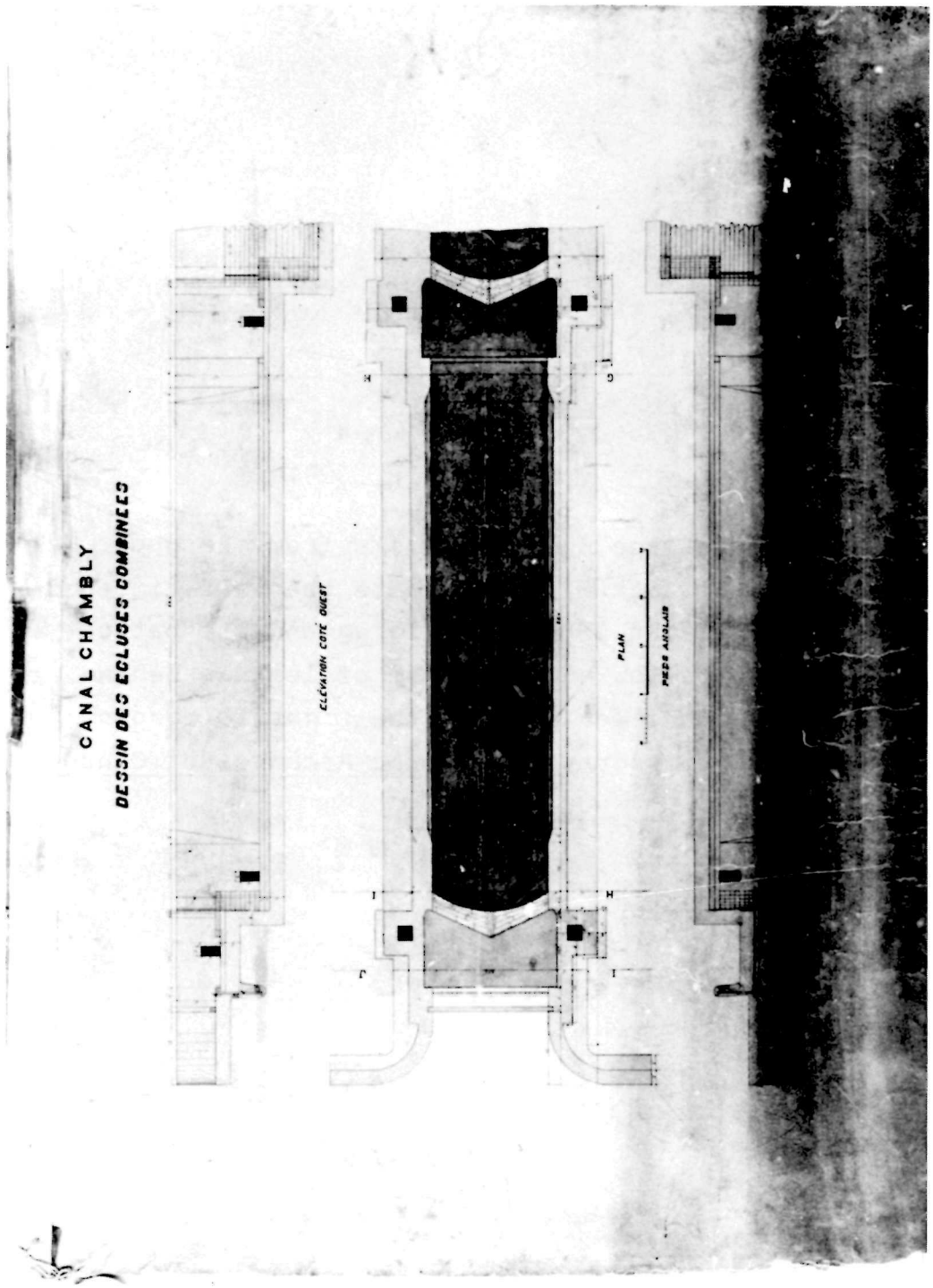
additions to the lock in this century. The upper mitre sill was renewed in concrete during the spring of 1914-15.[16] Then in 1922 a new concrete entrance wall was placed above the lock on the northwest side to prevent erosion and to provide anchorage for waiting boats.[17] Several years later it was reported that 10 feet of the east wing wall had been rebuilt, apparently with the original stone.[18] (This is the first reference to repair of the wing walls at the top of the lock.)

During the early 1930s steel plates were installed in the hollow quoins of lock 3, as they were in the other locks on the canal, to prevent further wear on the masonry and to give extra strength to the quoins.[19] During World War II a concrete floor was laid in the upper entrance to prevent leakage under the gate.[20] Sometime later the walls were faced with a thin layer of concrete to serve as a sealer.

In recent years the masonry wing walls, which serve also as the abutments for the highway bridge across the canal, were taken down and rebuilt in concrete.

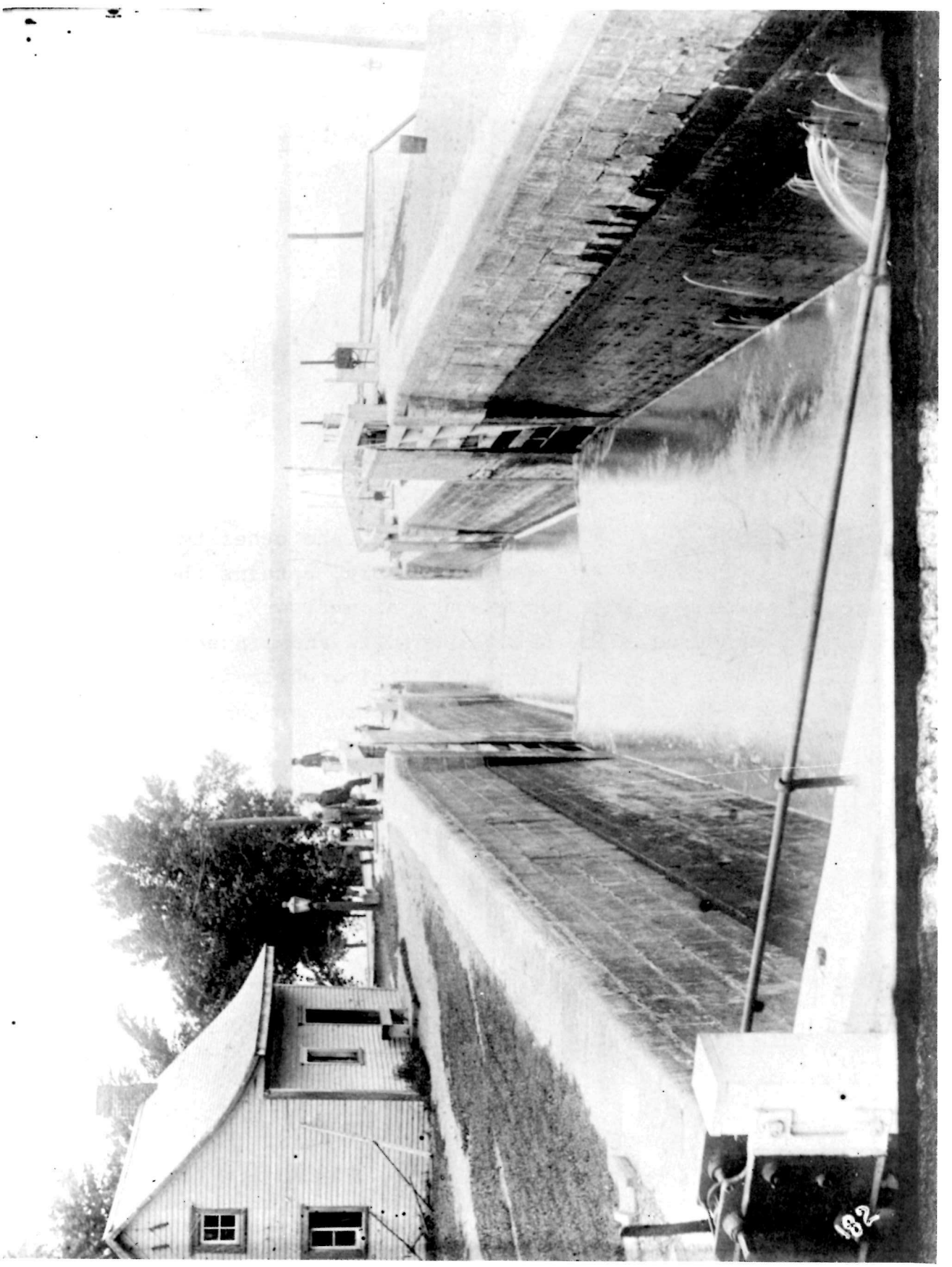
The Lock Today

Today lock 3 retains its original masonry floor built by Lauder, Whitlaw and Tennant in 1842. Much of the original breast wall remains as well. The chamber walls, with the exception of the crumbling concrete facing, are essentially those built by the Department of Railways and Canals in the early 1890s. The major losses to the historic structures are the wing walls at the upper entrance to the lock.

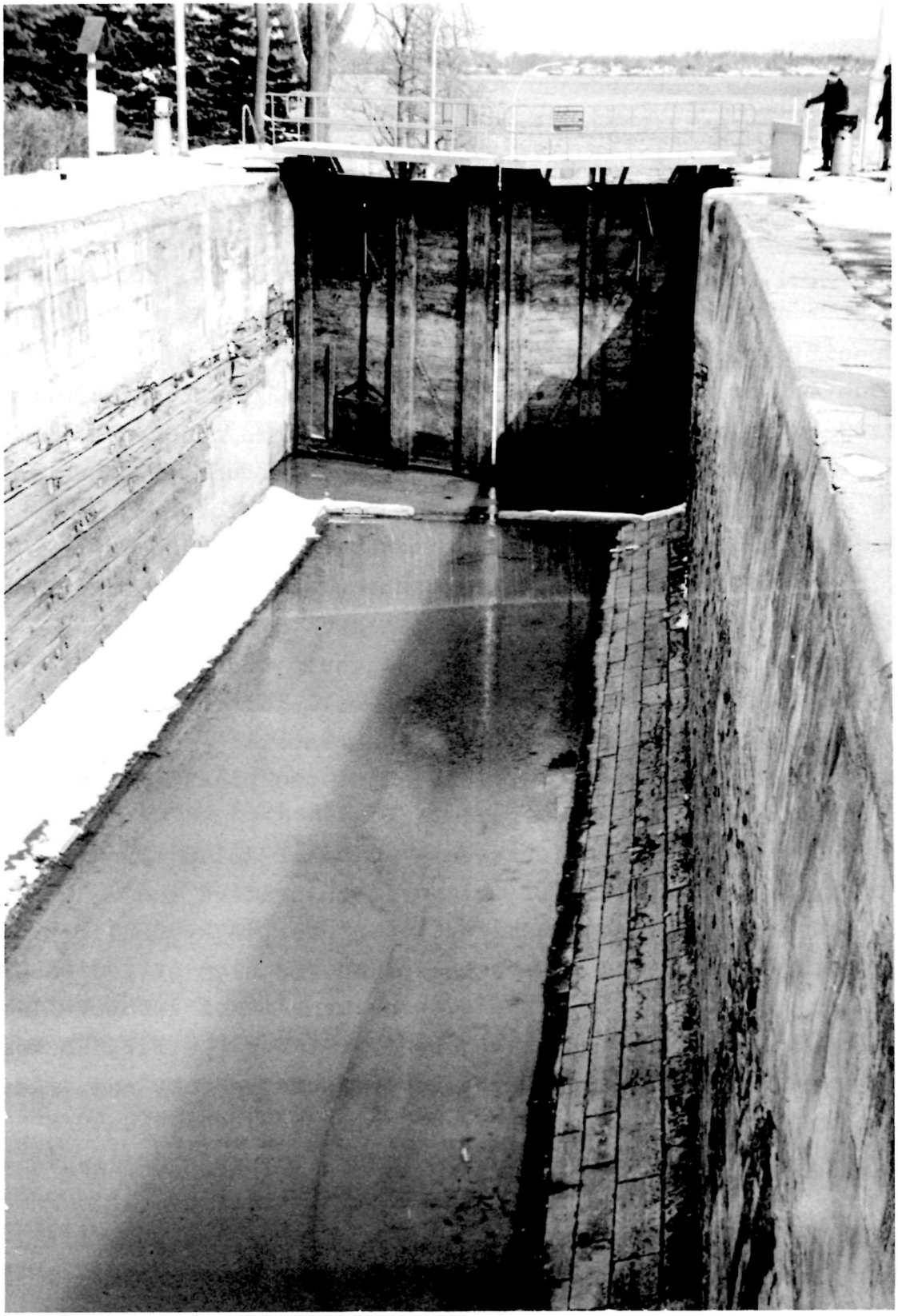


13 J.E. Doré's plan for the reconstruction of the upper lock, ca. 1882. (Quebec Canal Office, Parks Canada, Montreal.)

14 A view of the combined locks from the upper gates of lock 3, 1891. Note the half-timbered style of the 1880s rebuilding and the batter of the walls. The problem of leakage behind the walls is evident in the right foreground of the photograph. (Public Archives of Canada.)



15 Lock 3 in 1973. Lock 3, like the other two locks in the flight at Chambly, retains the original inverted masonry arch floor constructed by Lauder, Whitlaw and Tennant in 1842. Note the concrete facing which is crumbling off the timber section of the walls.



Lock 4

Specifications, 1831 and 1834

Lock 4, sometimes known as Meyott's Lock,[1] was constructed between about 1833 and 1835 under the terms of the 1831 and 1834 contracts (see Apps. B and C). Unfortunately the plans to which the contracts refer have not been located. According to the combined specifications the single locks were to be masonry structures resting on timber foundations or on the bedrock if conditions allowed. If the engineer found the ground to be unstable he could order the timbers to be placed on piles or 2 feet of well-packed gravel. Gravel was to be placed between the timbers. The floor was to consist of one layer of 3-inch jointed plank covered with a second layer of 2-inch pine.

The walls of the locks were to be of solid masonry, consisting on the face of well-dressed headers and stretchers (in prescribed proportion) set in hydraulic cement. The backing was to be formed "mainly" of 200-pound stones laid in mortar. There is no mention of rubble. The thickness of the walls was to be 6 feet for the first 8 feet above the foundations, 5 feet for the next 4 feet and 4 feet for the last 4 feet to the level of coping, which was to be 2-1/2 feet. Buttresses, spaced every 12 feet and measuring 4 by 4 feet were to extend back from the rear of the chamber walls to give additional strength to the walls. Oversized buttresses 8 feet thick at the bottom and 24 feet and 17 feet in length were to be placed behind the gates, presumably at the upper and lower quoins.

Completed dimensions of the lock chamber were to be 24 by 120 feet. Wing walls were to extend upward from the upper hollow quoins a distance of 22 feet and downstream for 25 feet. The upper wing walls were then to project into the banks at right angles a distance of 10 feet and the lower wing walls for 20 feet. The lock was to be equipped with wooden gates.

Construction, ca. 1835

How closely the lock was built to the specifications is not known. There are no detailed estimates of the materials used in the construction of the lock as there are for the combined locks. Nevertheless we are able to piece together a brief description of the lock as it was when completed in 1834 or 1835.

Measuring 120 feet 6 inches in length and about 24 feet in width in the chamber, the lock overcame a fall of 7 feet 2 inches. The walls of the lock were built of cut stone from Isle La Motte backed with stone rubble from the nearby Chambly Quarry and from the canal excavation. (Later evidence indicates that the thickness of the walls was about 6 feet at the bottom.) The walls were supported in the rear by at least five and perhaps more masonry counterforts per side. The chamber walls were topped with a course of masonry coping, while the coping on the wing walls seems to have been left unfinished by the contractors. No mention was made of puddle at the time of construction, and canal officials later expressed doubt as to whether it was ever placed behind the walls. The embankment was said in 1867 to be about 15 feet wide with an outside slope of two to one.

The floor of the lock was of plank, apparently spiked or treenailed to the timber foundation resting on the bedrock. The masonry breast wall arch was placed above the

upper gate recess. The upper mitre sill was constructed of cut stone, while that at the lower gate consisted of oak timber to a height of one foot above the foundation. A wooden apron probably covered the lower gate recess floor.[2]

The supply of water for the lock came through sluices in the gates as in the other locks built in the first phase of construction of the canal. Thus there were no wall culverts as in lock 8 and the combined locks.

Repairs and Maintenance, 1835-55

Opened to traffic immediately upon its completion, lock 4 did not receive the upkeep necessary for its proper maintenance during the rest of the decade, due to the almost complete stoppage of public funds for the project. Nor did it fare much better during the busy times of the early 1840s when the combined locks were being constructed and Dubuc's (lock 8) rebuilt.

Minor repairs were made to the lock in 1842 when the planking in the bottom was re-spiked. Within two years the floor had again risen for a length of about 60 feet in the middle of the lock and it was proposed to secure them this time by placing "logs of timber" secured to the floor with ragbolts "clean across the centre."[3] Whether this proposal was actually implemented is not recorded.

Yet far more than the floor needed repair. By 1848 it was reported that the side walls were leaking, that the coping stones, the upper stone mitre sill and upper breast wall had been lifted and that the stones in the upper wings had been displaced. The situation was so serious that the masonry required to be reset, pointed and clamped. The work was done that fall. Three years later, in 1851, the coping stones on the wing walls, which had been left unfinished by the contractors, were bolted to the courses below. About

the same time timber fenders were placed along the wing walls to minimize the injury to the walls from boats crashing against them.[4]

In 1850 it was reported that the oak sill at the lower end of the lock had been displaced and that the stone upper sill, though fixed only two years earlier, had again moved. The canal superintendent recommended that both be fixed, the latter with iron bolts, one inch by 3 feet.[5]

Reconstruction, 1856-59

Continued neglect, in addition to probably shoddy construction in the beginning, meant that by the mid-1850s lock 4 was in such poor condition that much of it required to be reconstructed to prevent collapse. Between 1856 and 1859 the upper and lower wing and recess walls and a portion of the east wall above the lower gate were taken down and reconstructed, as before, in masonry laid in mortar. During reconstruction the puddle behind the walls - which had been totally washed away if it ever existed - was replaced. The west chamber wall was repaired during the same period.[6]

Repairs, 1860-70

During the decade of the 1860s repairs to lock 4 were few. Maintenance was confined to re-spiking the floor planking, replacement of fender timbers along the wing walls and repointing the facing stones.[7]

Reconstruction in Masonry, 1870-72

By 1869 it was clear that large portions of lock 4 were again in an unstable state and that reconstruction was again necessary. That year John G. Sippell, superintending

engineer of the Quebec canals, drew up a plan for new Chambly single locks which would be stronger than the existing structures. Sippell's proposals were not accepted by the minister of Public Works. When the specifications were issued in September 1870, they called for the reconstruction of only part of the lock - the central portion of the west chamber wall and the upper recess walls to include the quoins and piers below the gates. The work was to be done "on the same plan as the present walls," though one foot thicker at the bottom (see App. H).

The partial reconstruction of lock 4 took place during the spring of 1871. After the specifications had been issued it was determined that portions of the east wall required similar work and this was done by the contractors at the same time.

The record of the work completed by the contractors on the east and west walls indicates a massive reconstruction job involving 1,240 cubic yards of excavation, and requiring 490 cubic yards of masonry and over 1,500 cubic yards of puddle, even though the walls seem to have been dismantled only to the extent required. Stable portions of the lock structure seem to have been left intact and only re-grouted and pointed. "French drains" were built behind the works to improve the drainage. The job was completed by 1 May 1871.[8]

Whether the reconstructed portions of the walls were made one foot thicker than previously (as called for in the specifications) is not clear. It certainly seems unlikely. The major reconstruction work, as indicated in the plans submitted by the contractors, was not at the base of the walls, but rather in the higher courses of masonry. It certainly would not have been logical to have increased the width of the upper portions of the walls without increasing the width at the base. The width of the walls according to the plans was about 6 feet.

Further reconstruction was required on the lock the following year. In April 1872 another section of the east chamber wall was taken down and rebuilt with new facing stones.[9] The wing walls, although reported to be in urgent need of reconstruction, seem to have been left as they were. Indeed, lock 4, with the exception of a few minor repairs, received scant attention for the rest of the decade.

Rebuilding the Lock in Timber and Masonry, 1881-90

By the 1880s the lock, along with most of the other locks in the Chambly system, was in such a dilapidated condition that it again had to be reconstructed. Unlike the reconstruction of 1871 and 1872, it would not this time follow the original all-masonry style of the lock but rather be in the new half-timbered style adopted in this decade by the Department of Railways and Canals for the Chambly system.

First to receive attention was the lower west wing wall which, in 1881-82, was rebuilt in timber to the water-line and in masonry above. Two years later a new mitre sill was placed at the upper gates and the planking on the floor was replaced. About the same time timber cribs, filled with stone, were placed at the outer ends of the wing walls to protect them from damage from boats.[10]

The engineers turned their attention during the winter of 1887-88 to the chamber walls. During that year the lower west wing wall and gate recess and the east chamber wall, including the upper gate recess and upper wing wall, were rebuilt in pine timber and masonry on the face, with a rubble and cement backing.[11]

No sooner was the job completed and the lock open to navigation, however, than it was discovered that the east chamber wall, just rebuilt, was standing out of line. An insufficiency of puddle behind the wall had allowed water to

seep in behind the wall and to wash away the recently placed cement. As a result the rubble backing would have to be rebuilt the following winter. Meanwhile, to ensure the stability of the wall for the season, the canal staff placed iron braces through the walls and secured them to timbers placed vertically in the ground 20 feet behind the walls.[12] The wall was rebuilt the following year. (Whether the masonry on the upper east wing wall, as seen in a 1904 photograph,[13] was replaced with timber at this time or sometime later is not recorded.)

Lock 4 did not undergo the complete rebuilding during the 1880s as did most of the locks. The west chamber wall, reconstructed in masonry in the 1870s, was left as it was. It remained undisturbed until the 1930s.[14]

Partial Rebuilding in Concrete, 1900 to the Present

During this century the bottom of the lock and portions of the west wall have been rebuilt in concrete. The departmental report for 1901 states that the lower mitre sill had been taken up and the base on which it rests rebuilt in concrete; the following year a similar job was done to the upper sill.[15] Ten years later, during the winter of 1911-12, the plank flooring was taken up and replaced with concrete.[16] Further concrete work was done during World War I when one of the sills was filled in and covered with concrete. A similar job was done in "reinforced concrete" on the lower apron for a distance of 25 feet in 1925.[17]

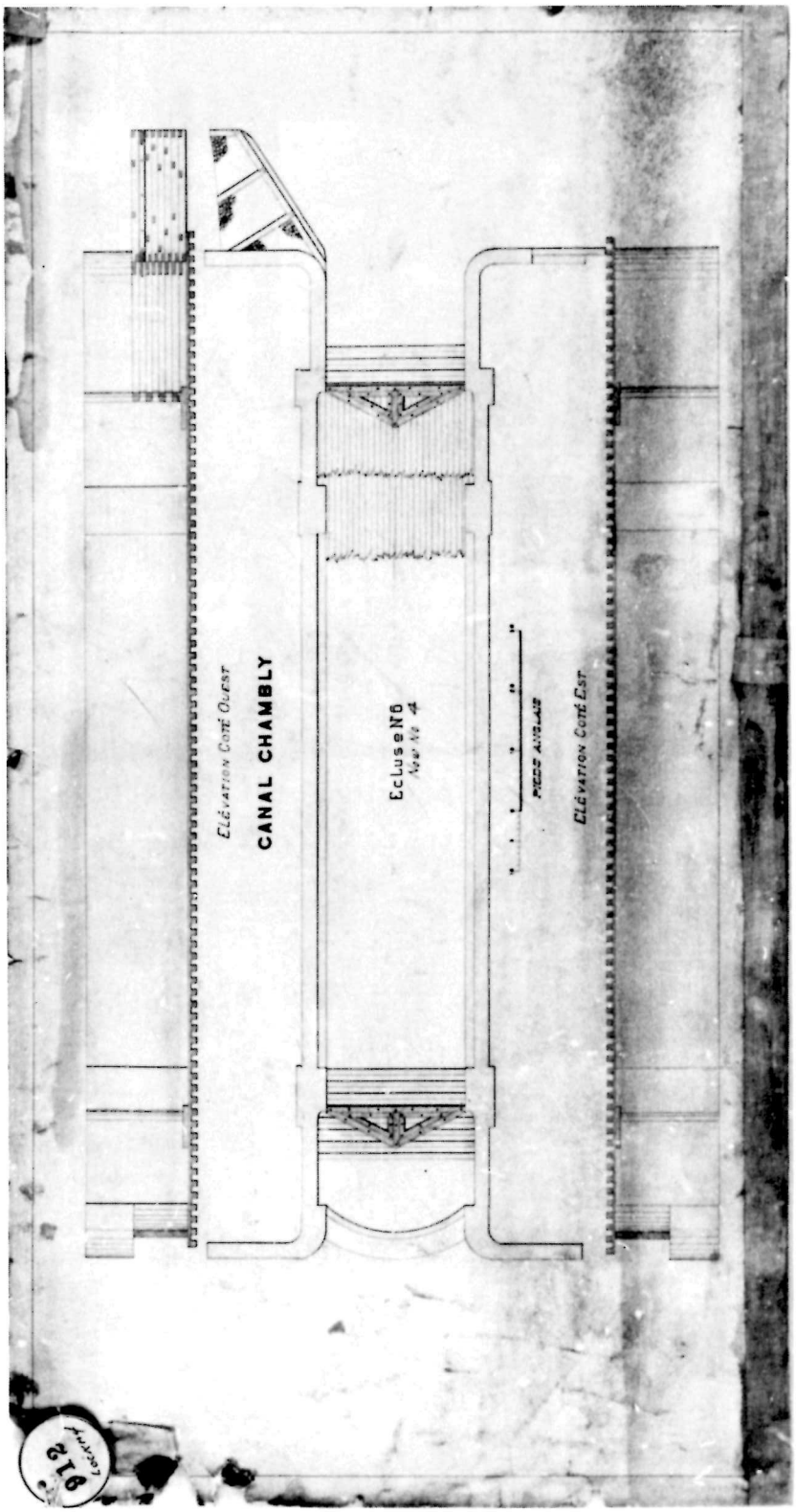
During the 1930s the last major repairs were made to the lock structure. The lower entrance walls were rebuilt in concrete in 1933 and 1934. Rebuilt in concrete the following year were the upper portion of the west wall, including the wing, gate recess and part of the chamber

wall for a total distance of 45 feet.[18] Only the centre portion of the chamber wall was left in masonry (Figs. 17 and 18).

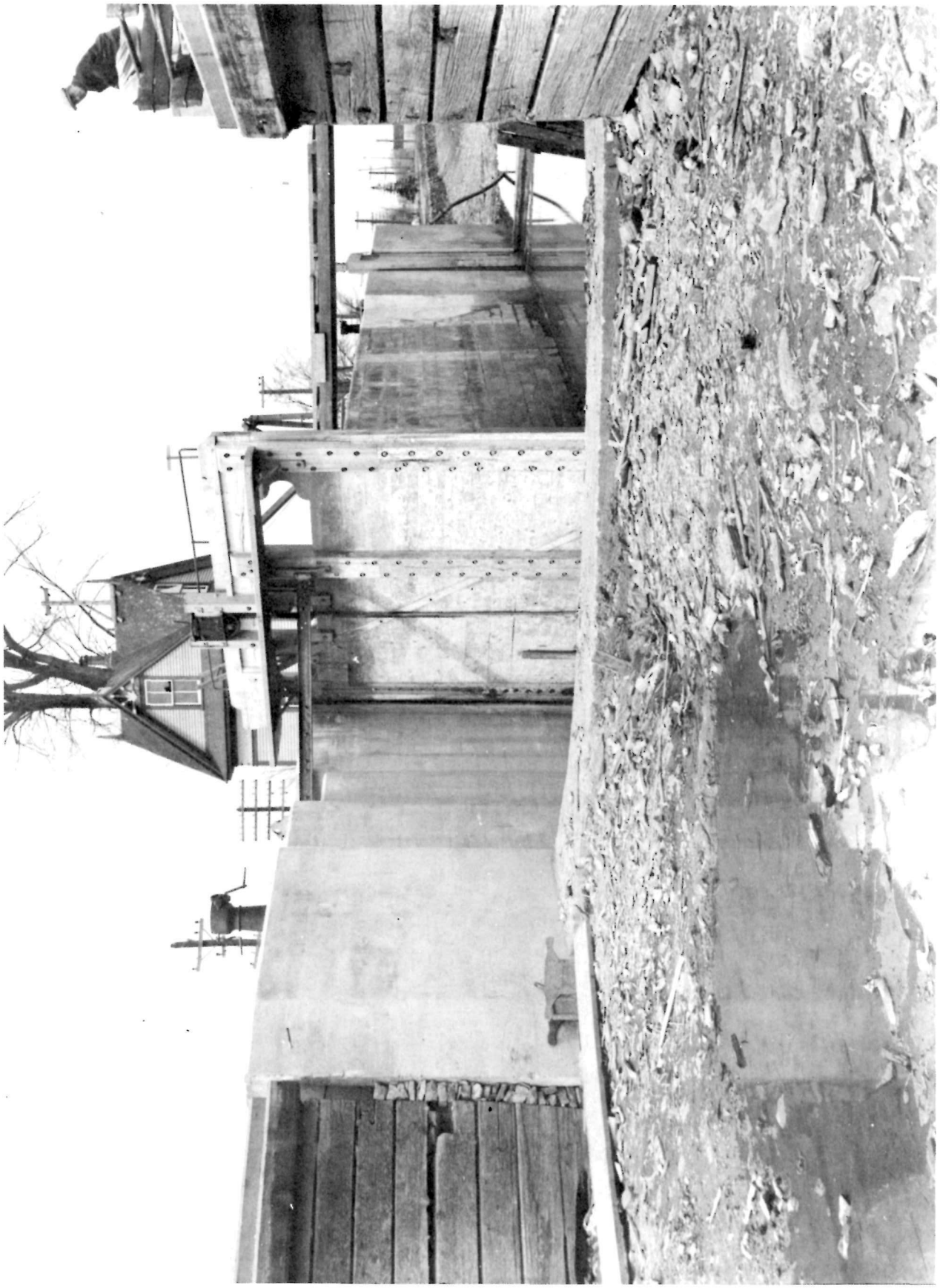
The Lock Today

Since its completion in 1835 and its partial rebuilding in the 1880s, lock 4 has received considerable alteration. On the west side only the masonry centre portion has escaped dismantlement and replacement in concrete. This masonry area dates from the reconstruction of 1871. The east side of the lock, with the exception of the concrete entrance walls, is today essentially as it was rebuilt in the 1880s, though in places there has been an attempt to cover the face of the timber and stone with a thin layer of concrete. Much of the original breast wall remains.

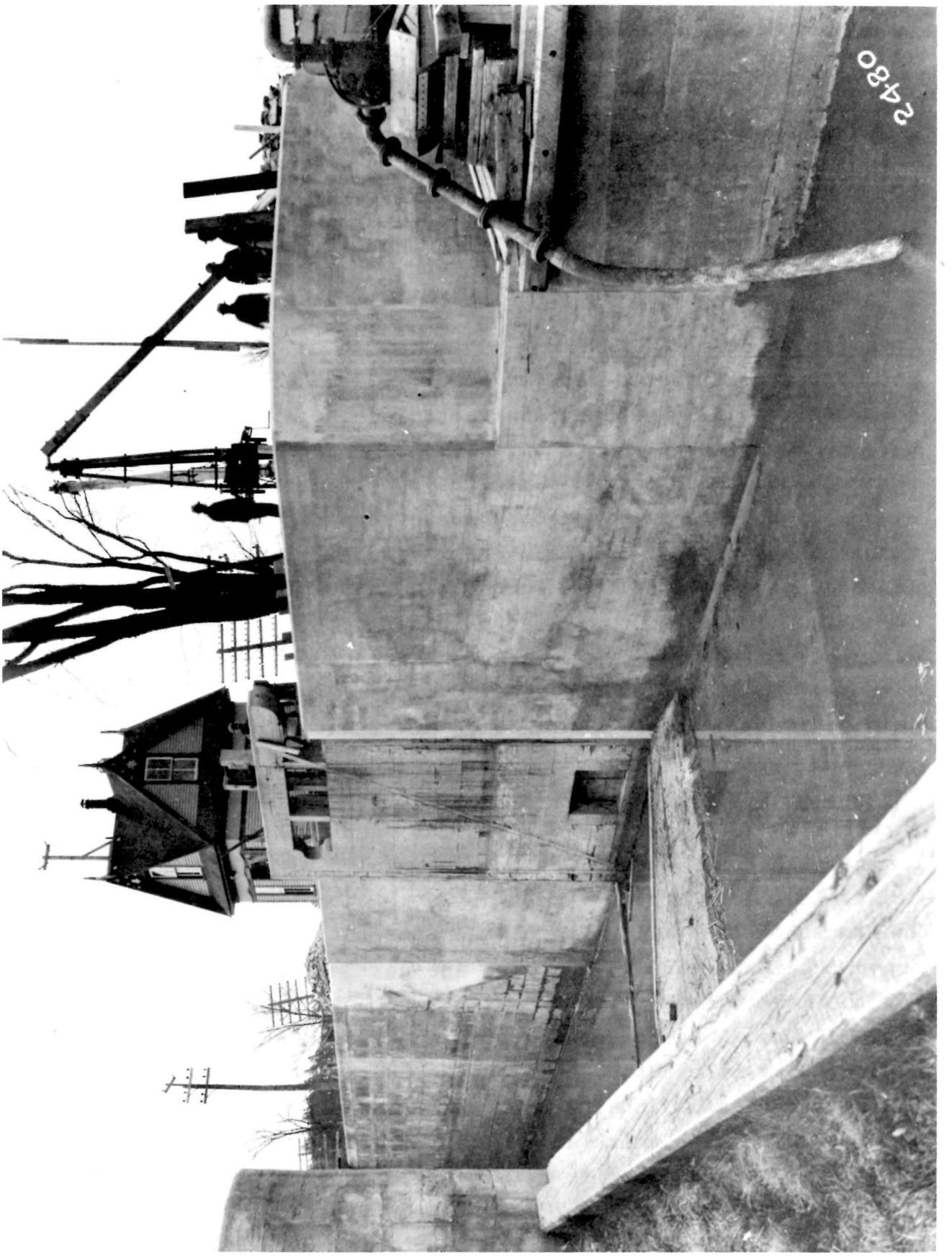
16 J.E. Doré's plan, ca. 1882, for the rebuilding of lock 4. (Quebec Canal Office, Parks Canada, Montreal.)


Elévation Coté Ouest
CANAL CHAMBLY
Ecluse N6
Elévation Coté Est

17 The upper west wall of lock 4, 1935. A photograph of the recently reconstructed portions of the west wall in concrete. Note the masonry central portion of the wall. Note also the concrete topping on the breast wall. (Public Archives of Canada.)



18 Reconstruction of the lower west chamber, recess and wing walls of lock 4 in concrete, 1935. (Public Archives of Canada.)


2480

Lock 5

Specifications, 1831 and 1834

Lock 5 was constructed between about 1833 and 1835 under the terms of the 1831 and 1834 contracts (see Apps. B and C). Unfortunately the plans to which the contracts refer have not been located. According to the specifications, the single locks were to be masonry structures resting on a timber foundation or on the bedrock if conditions allowed. If the engineer found the ground to be unstable he could order the timbers to be placed on piles or 2 feet of well-packed gravel. Gravel was to be placed between the timbers. The floor was to consist of one layer of 3-inch jointed plank covered with a second of 2-inch pine.

The walls of the locks were to be of solid masonry, consisting on the face of well-dressed headers and stretchers (in prescribed proportions) set in hydraulic cement. The back was to be formed "mainly" of 200-pound stones laid in mortar. (There is no mention of rubble.) Thickness of the walls was to be 6 feet for the first 8 feet above the foundation, 5 feet for the next 4 feet and 4 feet for the last 4 feet to the level of the coping, which was to be 2-1/2 feet. Buttresses, spaced every 12 feet and 4 feet square, were to extend back from the rear of the chamber walls to give additional strength to the walls. Oversized buttresses, 8 feet thick at the bottom and 24 feet and 17 feet in length, were to be placed behind the gates, presumably at the upper and lower quoins respectively.

Completed dimensions of the lock chamber were to be 24

by 120 feet. The wing walls wre to extend upward from the upper hollow quoins a distance of 22 feet and downstream for 25 feet. The upper wing walls were to project into the banks at right angles a distance of 10 feet and the lower walls 20 feet.

Construction, ca. 1835

How closely the contractors adhered to the specifications in the construction of lock 5 is difficult to say. There are no detailed statements of the materials used in the construction of the lock as there are for the combined locks and lock 8. Nevertheless, from scattered comments and descriptions we are able to piece together a brief description of the lock as it was when completed about 1835.

Built to accomplish a lift of 8 feet and to carry a 6-foot depth of water on the mitre sills, the chamber measured 120 feet 8-1/2 inches by 24 feet. The walls were of cut-stone masonry obtained from Isle La Motte, backed with rubble obtained locally; width of the walls (as found in the dismantlement of the lock in 1892) were 8 feet - 2 feet wider than specified in 1834 - and the counterforts were about 4 feet square. The stone was laid in cement or mortar. Although masonry coping was to have been laid along the top of the whole length of the walls, the contractors left the job unfinished on the upper, and probably the lower, wing walls. It was not until 1852 that the coping was completed.[1]

Whether a puddle trench was placed in the rear of the wall after its completion is not known. The embankments on both sides of the lock were said in 1867 to be 15 feet wide with outside slopes of two to one.

The floor of the lock was of wood plank, probably like the other locks placed on a timber foundation. In 1856 it

was said that the lock structure was built upon a "rock foundation." Thus the number of piles required to be driven to support the lock chamber would have been reduced or done away with.

The masonry breast wall was placed above the upper gate recess. The upper sill was of stone masonry, while the lower sill was of oak, built one foot above the top of the foundations.[2]

Maintenance and Repairs, 1835-56

Apparently badly built in the beginning and then neglected afterwards, the lock by 1848 was leaking badly, and much of the masonry in the upper mitre sill and in the wing, breast and chamber walls had been displaced. That fall the dislodged stones were reset and in some cases clamped.[3] The work on the mitre sill must have been done poorly; after only one season's use the upper stones had again moved. The canal superintendent reported that he intended to fix it with iron bolts one inch in diameter and 3 feet long which, one assumes, were to be secured to the foundation timbers.[4] (Even this must have proved unsatisfactory after a time; for by 1867, the department seems to have given up on stone sills and replaced the one on lock 5 and others in the system with an oak sill.)

When the lock was opened to traffic in the 1830s, the wing walls, as mentioned earlier, were left without their intended layer of coping. Finally in 1851, after the water level in the canal had been raised one foot (thus exposing the upper masonry to considerable damage from boats locking through) the department set about completing this job on all the locks. The wings of lock 5, however, were not done that year, as canal engineer J.F. McDonald reported, "because the whole masonry of the lock must be taken down and rebuilt

before next season."[5]

It is doubtful if McDonald's plans for the reconstruction of lock 5 came to fruition. Indeed, the only reference to the lock in the estimates for 1852 was for two days' pay for a mason to lay the coping on the lower wing wall and enough cement to do the job.[6] (Whether the upper wing walls were to be left without coping or whether the job had already, in fact, been done, is not known.) Moreover, a report on the repairs required on the Chambly Canal submitted to the department in 1853 described the condition of lock 5 as "ruinous" and predicted that the lock would last only a year or two longer.[7] Fortunately the lock proved more solid than predicted, for the government of the time showed little inclination to spend money on the canal. Again in 1856 the canal authorities repeated that the walls of many locks - but lock 5 in particular - were moving inward, that loose facing stones were falling into the locks and that they were only held in place by wooden wedges driven between them. Water was seeping through the walls and down behind the lower wings. They reported that a portion of the embankment had been removed from the rear of the west wall of lock 5 to drain the water and to take pressure off the walls. It was recommended that the chamber and lower recess walls be rebuilt.[8]

Reconstruction in Masonry, 1857-80

The money for the reconstruction of lock 5 was finally forthcoming, and the dismantlement of the east and west chamber and the lower recess walls began in March 1857. During the process it was seen that the mortar and puddle, if ever they were there, had been washed away and replaced with ice and water.

Before the walls were taken down, John G. Sippell,

superintending engineer for the Quebec canals, had ordered that the stones were to be marked so that they could be relaid in their old positions. He had also ordered that there was to be a 3-foot wide layer of puddle placed behind the walls extended well beyond the recesses to prevent future problems. Sippell's optimism concerning the reusability of the masonry, however, proved ill-founded. During removal, much of the facing stone fell apart and consequently had to be replaced. What Sippell called "backing stones" (perhaps suggesting a smooth back face on the lock) were found in his opinion to be too small to enable them to make a good bond. Sippell nevertheless promised the department to do the best job he could under the circumstances.[9] This Sippell seems to have done, and the lock was again open to navigation that spring.

For the next decade, the lock received only the usual periodic repairs, such as new timber fenders at the entrances and pointing.

Once again by 1869 there were reports on the "very dilapidated condition" of the lock, particularly the west chamber wall which, it was felt, could not last another season. It was dismantled and rebuilt that winter, though whether it was rebuilt to its old dimensions or with thicker walls, as recommended by Sippell, is not recorded.[10] Three years later the lower east wing wall was also taken down and rebuilt. During the following spring, the lock received further attention when the walls were repaired - though no details are given - and the bottom replanked. Over the winter of 1879-80 the upper east pier was rebuilt. Four years later a new sill was placed at the upper end and the planking on the bottom of the lock replaced.[11]

Partial Rebuilding in Timber and Masonry, 1885-93

During the rebuilding program of the 1880s and early 1890s

the east wall of lock 5 was rebuilt in timber and masonry, while the west wall - reconstructed in masonry in the previous decade - proved sufficiently stable to be left as it was. Over the winter of 1884-85 the east side of the lock was taken down and rebuilt, the lower portion with nine tiers of timber with a concrete backing and the upper with ashlar masonry set in cement mortar.[12] Exactly how much of the east wall was affected is not stated, though it was probably then that at least the upper portion of the chamber wall, the upper gate recess and the upper wing wall were rebuilt in this half-timbered fashion.

The rebuilding of the east wall resumed in 1892-93. Fortunately a detailed description of the work done has been preserved.

> The east wall of Lock No. 5, from a point about 10 feet below the upper gate, comprising the recesses, abutments, chamber and wing walls below the lower gate, was taken down as far as the bottom of the lock, and rebuilt for a height of 17 feet. Eight tiers of dressed pine timber with a batter of 1 inch to the foot were laid one upon the other with ten tiers of hemlock timber in rear, the whole joined together by iron rag-bolts.
>
> The stone masonry backing in the rear was built in the same time and bound to the timber wall in front for a height of 10 feet 4 inches, by means of numerous iron bars 1-1/4-inch in thickness by 8 and 12 feet in length, put across the whole wall and bolted to oak blocks embedded in rear of said wall.
>
> In the spring, four courses of face stone course, 3 feet in width, was put on top of

> this wall. The work once completed, the two derricks, the electric lamps, the surplus of materials were removed, the ground levelled and some gravel spread over the approaches to the lock and in the vicinity.
>
> The appropriation to rebuild 90 feet of wall was $6,000; but when it was taken down it was perceived that the remainder of the wall, including the wing wall, was worthless; order was therefore given to demolish the same, which gave 60 feet more of wall to rebuild. An additional sum of $1,500 was appropriated.[13]

(It should be noted that the main chamber wall, from the length of the bolts required to secure the facing timbers to the rear of the wall, must have been about 8 feet at the bottom and at the counterforts about 12 feet.)

The Twentieth Century

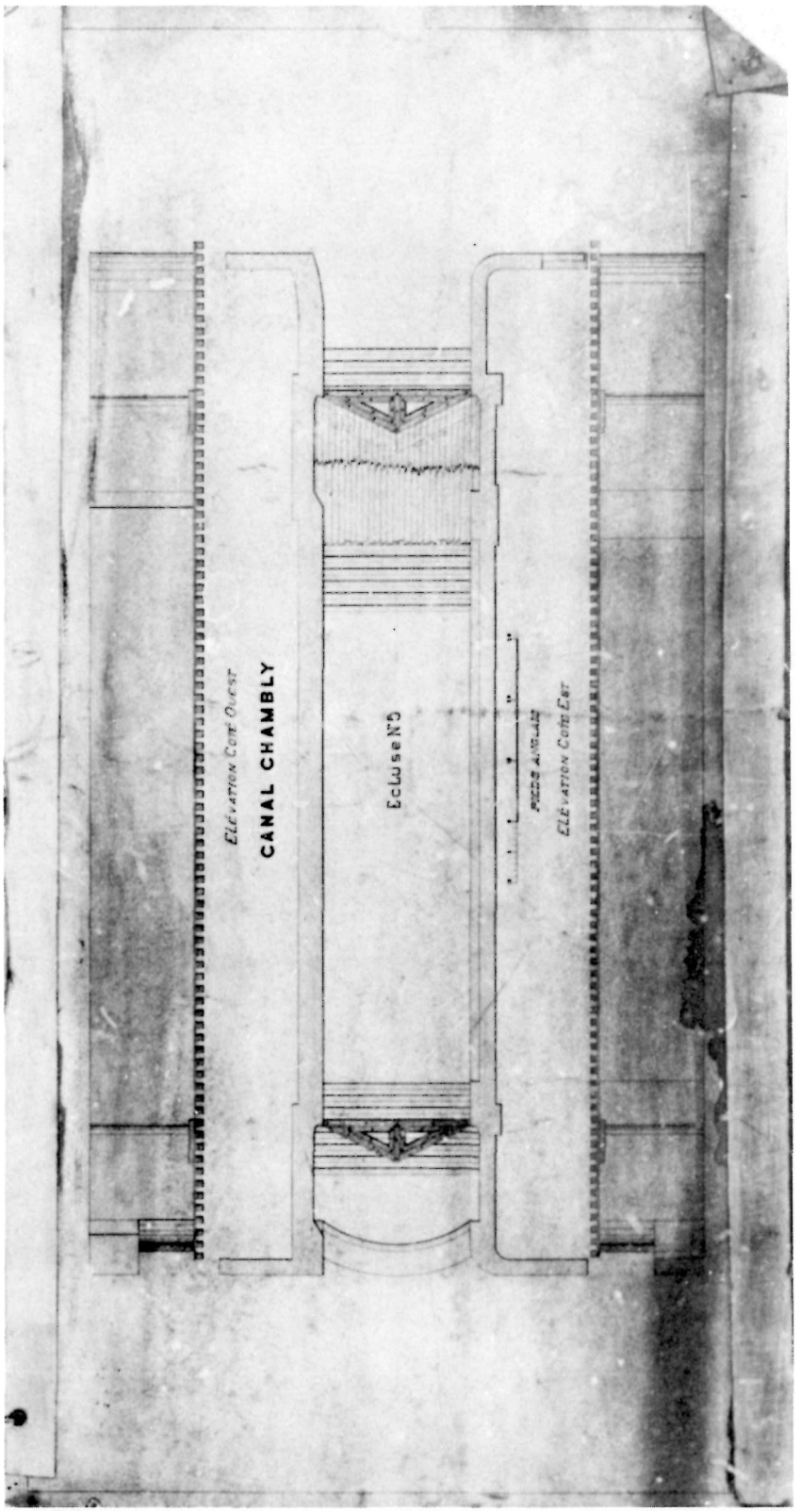
During this century repairs to lock 5, as on the other locks, have relied upon concrete as the primary - though not the only - construction material. In early 1901 bases of cement (probably replacing stone) were made for the pivots. Over the winter of 1908-09, the wooden hollow quoins, presumably on the east side, were rebuilt in stone.[14] No major repairs then seem to have been done on lock 5 until the spring of 1926 when, the department reported, a 60-foot portion of the lock was reconstructed.[15] Unfortunately precisely what section of the lock received this major work is not recorded. Steel plates were installed in the hollow quoins over the winter of 1931-32.[16] Sometime during this century - though the precise dates are not recorded - the entrance walls, as well as the lower apron and mitre sill, were rebuilt in concrete. The upper sill and breast wall

were "renewed" with this material. The lock, along with the others in the system, was regrouted in 1954 and 1955.[17]

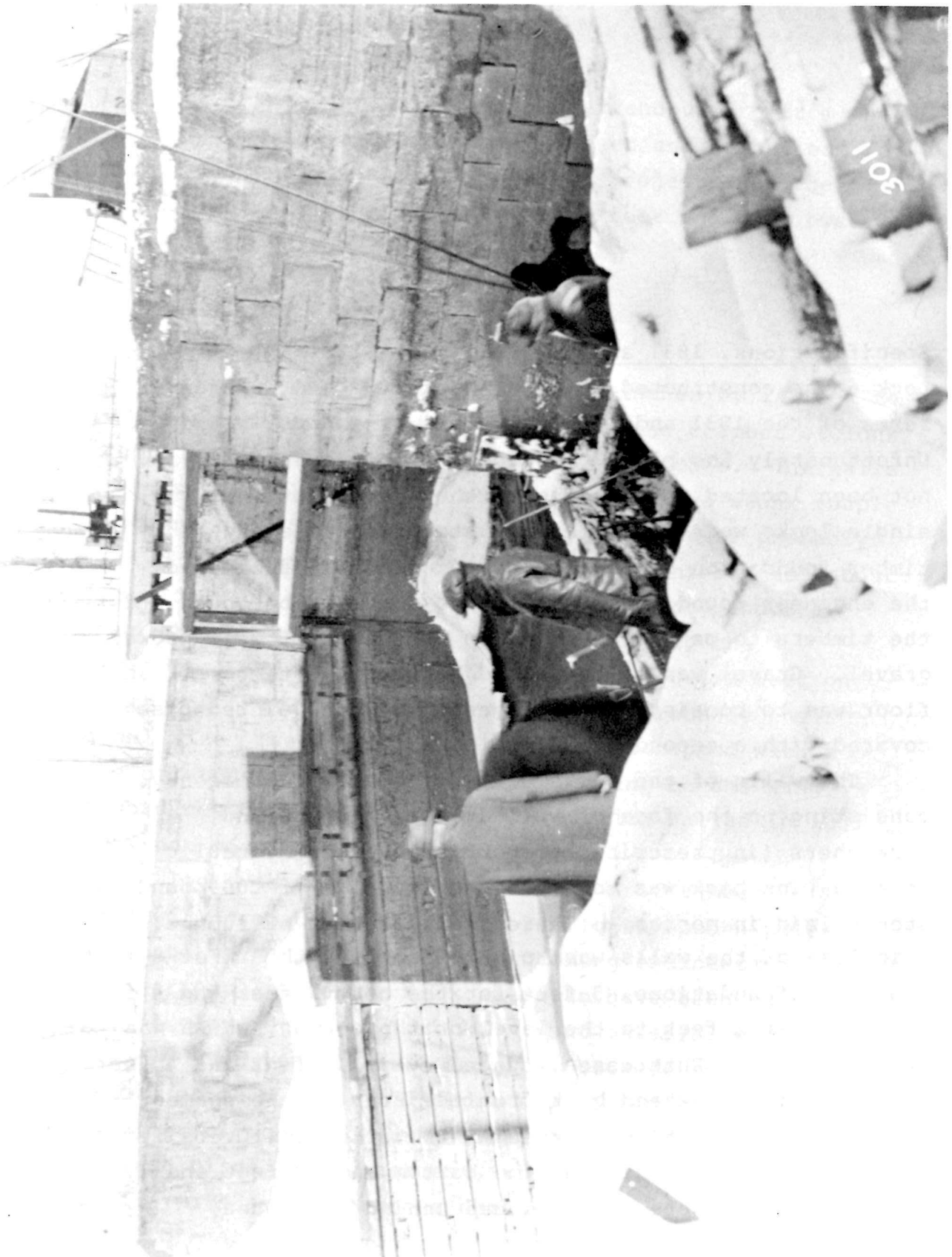
The Lock Today

Today the west side of the lock remains as it was reconstructed during the 1870s in solid masonry. The east wall, on the other hand, consists of layers of horizontal timbers topped with four courses of stone and one of coping as it was rebuilt between 1885 and 1893. The bottom of the lock is concrete, although much of the original breast wall remains. All the entrance walls, replacing the old stone-filled cribs, are concrete with wooden fenders. One can still see the outline of a masonry wall, perhaps the upper west wing wall or a buttress running almost perpendicular to the upper west recess wall above the gate. It is now almost covered with sod and hidden from view by the new entrance wall. Further excavation will no doubt provide the answer to the question of the purpose of this wall.

19 Doré's plan for the reconstruction of lock 5, ca. 1882. (Public Archives of Canada.)


CANAL CHAMBLY
Elevation Cote Ouest
Ecluse N°5
Elevation Cote Est

20 The lower entrance to lock 5 showing the stone-filled crib entrance walls, 1944. (Public Archives of Canada.)


3011

Lock 6

Specifications, 1831 and 1834

Lock 6 was constructed between about 1833 and 1835 under the terms of the 1831 and 1834 contracts (see Apps. B and C). Unfortunately the plans to which the contracts refer have not been located. According to the specifications, the single locks were to be masonry structures resting on a timber foundation or on bedrock, if conditions allowed. If the engineer found the ground to be unstable he could order the timbers to be placed on piles or 2 feet of well-packed gravel. Gravel was to be placed between the timbers. The floor was to consist of one layer of 3-inch jointed plank covered with a second of 2-inch pine.

The walls of the locks were to be of solid masonry, consisting on the face of well-dressed headers and stretchers (in prescribed proportion) set in hydraulic cement. The back was to be formed "mainly" of 200-pound stones laid in mortar. (There is no mention of rubble.) Thickness of the walls was to be 6 feet for the first 8 feet above the foundations, 5 feet for the next 4 feet and 4 feet for the last 4 feet to the level of the coping, which was to be 2-1/2 feet. Buttresses, spaced every 12 feet and 4 feet square, were to extend back from the rear of the chamber walls to give additional strength to the walls. Oversized buttresses, 8 feet thick at the bottom and 24 feet and 17 feet in length, were to be placed behind the gates, presumably at the upper and lower quoins respectively.

Completed dimensions of the lock chamber were to be 24

by 120 feet. The wing walls were to extend upward from the upper hollow quoins a distance of 22 feet and downstream for 25 feet. The upper wing walls were to project into the banks at right angles a distance of 10 feet and the lower walls 20 feet.

Construction, ca. 1835

Built to dimensions of about 120 feet 9 inches by 24 feet to carry 6 feet of water on the mitre sill, the chamber of lock 6 accomplished a rise or fall of 8 feet 2 inches. The walls were built of ashlar masonry at the face with a stone rubble backing and cut stone at the rear face; they were probably supported by a number of dressed masonry counterforts (about 10 per side) approximately 4 feet square spaced about 10 feet apart. Thickness of the walls (excluding the counterforts) was found in 1973 to be about 6-1/2 feet on the west and 5-1/2 feet on the east side, probably their original size[1] (see App. I). The wall was topped with a course of stone coping, although the coping on the wing walls had not been placed when construction halted in 1835 and was not completed until 1851.

The lock was built upon a foundation of timber. (The timbers will probably be found to rest upon wooden piles driven into the ground in the forthcoming engineering investigations, since the lock seems to have been built upon a base of clay rather than rock.) What material was originally used to fill in the spaces between the timbers is not known at this time. Placed over the timber foundation was a floor of wood planking. Behind the wall, above ground level, was placed an embankment, reported in 1867 to be 15 feet wide with a two to one slope on the outer face.

The breast wall, built of ashlar masonry, was placed above the upper recess. The upper gate closed against a

stone mitre sill while the lower sill was of oak, a height of one foot above the foundation. A wooden apron probably covered the area from the lower mitre sill down to the lower end of the wing wall.[2]

The lock was opened to traffic immediately upon its completion.

Repairs and Reconstruction in Masonry, 1848-82

The small grants made to the commissioners for the preservation of the canal in the late 1830s and the concentration between 1840 and 1843 on finishing the canal meant that lock 6, like the other completed locks, received little maintenance and repair. As a result by 1843, the year in which the whole line of canal was opened to traffic, lock 6 was said to be in need of major repair.

In September 1848, the commissioners of Public Works were forced to order a stoppage of canal traffic in order to make urgent repairs to the west wall, which was threatening to collapse. The west chamber wall, according to an expert, Mr. Walton, who had examined the lock in August, had moved inward 7 inches in just 3 weeks. The cause of the problem was said to be water leaking behind the walls, which had "undermined" the foundation. Walton proposed taking down and rebuilding the wall (after repairing the foundation and excavating a puddle trench 6 feet wide from the depth of the foundation up to one foot above the water line) to prevent similar problems in future. Walton added - with no small hint of sarcasm - that such a trench "is an ordinary precaution against leaking in making lock embankments, but seems to have been either omitted, or imperfectly performed on this canal."[3]

Walton also proposed that the masonry on the east wall be repointed and that the coping stones of the breast wall

be reset and clamped. Yet, when the water was drawn off the lock that autumn and the structure examined carefully, it was found that the east wall was equally in need of rebuilding "in a more substantial manner."

The work of reconstruction on lock 6 was done during the winter of 1848-49, although it is unclear from the departmental records whether it was only the west wall or both walls which were rebuilt. At the same time the cut stone sill at the upper end was fixed, although the work had to be done again the next winter. (Canal superintendent Mr. M. Borne stated that he intended to secure the stones with one-inch iron bolts 3 feet long.) Fender timbers were placed on the wing walls to reduce future damage to the masonry.[4]

It is doubtful that the reconstruction in 1848-49 - whether of one or two walls - was done in a "more substantial manner" than the original walls which, as the commissioners pointed out, had been built "much too thin" and of a material of "inferior quality." Indeed, by 1853 lock 6 was again described as in "ruinous condition." Mr. Borne warned that unless the whole west wall and about 50 feet of the upper east wall were rebuilt in masonry laid in "hydraulic mortar" the lock would collapse within a year or two and tie up the whole system of navigation.[5] Yet no further reconstruction is recorded in the Board of Works records following this warning. Nevertheless, the chamber and upper wing walls of the lock were described in the annual report of the Department of Public Works for 1859 as being in good condition, an unexplained change of opinion. The lower wings and recess walls, however, were in poor condition with the facing stones held in place by wooden wedges driven between them. They were dismantled that fall and rebuilt in April 1860.[6]

Not until the 1870s did lock 6 again receive anything

more than standard repairs such as the replacement of worn-out fender timbers and repointing. Then, in another burst of rebuilding, the department dismantled and rebuilt a large part of the masonry east wall during the winter of 1871-72 and replanked part of the floor two years later.[7] More work was done at the end of the decade. In the off season of 1878-79, the projecting stones were dressed down and the mitre sills repaired. Two years later the piers on the east side were taken down and rebuilt with new stone and the lower wing wall was reconstructed - also apparently in stone - and a French drain made in the bank to improve the drainage. A new mitre sill was built, probably again in oak, at the lower end of the lock.[8]

Rebuilding the Lock in Timber and Masonry, 1882-92

Work, beginning in 1882 and continuing in piecemeal fashion for a decade, left the lock entirely rebuilt in the half-timbered style adopted in this era by the department for the Chambly system (Fig. 22). The first to be done was the lower wing wall, which was rebuilt in the spring of 1882 in timber to the water-line and in masonry above. Timber cribs filled with loose stone were placed at the wing walls to serve as entrance walls and to protect the wings from damage. A mammoth job was done on the lock three years later when the upper wing walls, upper recess and part of the chamber walls at the upper end were rebuilt for an unspecified distance on both sides, the lower nine tiers in timber with a concrete backing and the upper portion with ashlar stone set in cement mortar.[9]

Within a few years, however, it was discovered that, through frost action, the west chamber wall was projecting so far forward that it required rebuilding. Seventy-four feet, including a recess wall and a wing wall, were taken

down and rebuilt in only 15 days in the spring of 1888 so that navigation could open by 6 May. The job had been done speedily and, as it turned out, improperly. When the water was let into the lock it was discovered that the chamber wall was still standing out of line. The absence of an adequate puddle trench at the upper end of the lock had allowed seepage behind the wall, had washed away the recently laid cement and had separated the wall from its backing. For that reason iron braces were attached to timbers placed in the ground 20 feet behind the walls to keep the wall stable. During the following spring the west wall was rebuilt.[10]

The program of rebuilding lock 6 continued and was completed in the early 1890s, when the lower portion of the east chamber wall, including the abutment and the lower gate recess, were taken down for a distance of about 90 feet and rebuilt. At the same time the coping - which had been wood for an unspecified length of time and distance along the lock - was replaced by a course of stone coping.[11] Other repairs at the same time included the replacement of one hollow quoin coping and two regular coping stones. The new coping was secured to the masonry below with bolts leaded into holes drilled into the stone.[12]

Partial excavation in February and March 1974 of the east and west chamber walls has provided us with more information on the work done on the lock during the 1880s and 1890s, since the walls have not been materially changed since then.[13] The timber portion of the west wall, the only wall tested, was found to be two layers of timber thick, each about 14 inches square. Behind the timber and masonry on both sides of the lock are walls of rubble set in cement which go down to the bottom of the lock. The rear face of the walls is of dressed masonry with various sized counterforts, also of dressed stone, at various intervals.

The timber courses were found to be secured to the rear of the counterforts with long bolts. Clay puddle was found behind the walls. The timber foundation of the lock chamber protrudes 6 feet under the west wall. Boreholes were not made in the east wall, nor was the spacing between the timber determined. (For the engineer's report see App. I.)

Repairs and Rebuilding in Concrete, 1900 to the Present

Alterations to the lock during this century have generally involved replacement of worn-out parts of the structure with concrete. In 1901 and 1902 the wooden mitre sills were taken up and concrete platforms built to support them. Then just before World War I the plank floor was removed and replaced by concrete.[14]

Although expenditures on the canal were kept to a minimum during the war, the condition of the lower west wing wall demanded immediate attention. Consequently it was dismantled and rebuilt - in timber and masonry, not in concrete as one might have expected - in the spring of 1917.[15]

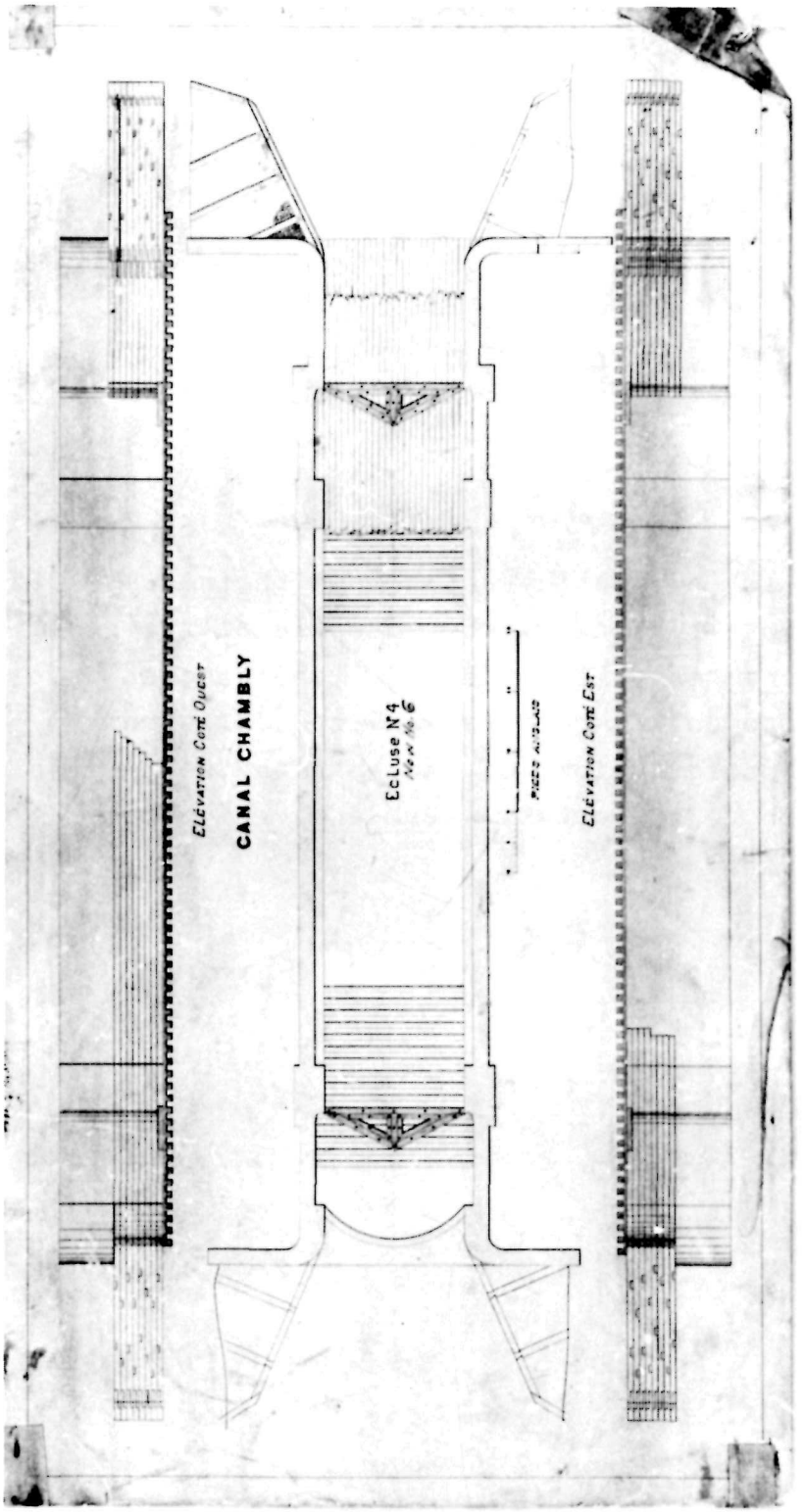
Little major work was again done on lock 6 until the 1930s. In the spring of 1931 the lower east entrance wall was "renewed" in concrete.[16] Several years later the lower sill and the apron below were also "renewed," or covered, with concrete. "Renewal" proved inadequate and, in the next decade, the apron and the lower east entrance wall had to be entirely demolished and rebuilt in concrete.[17] Since then the lower east wall and the lower west entrance wall have been rebuilt in concrete.

The Lock Today

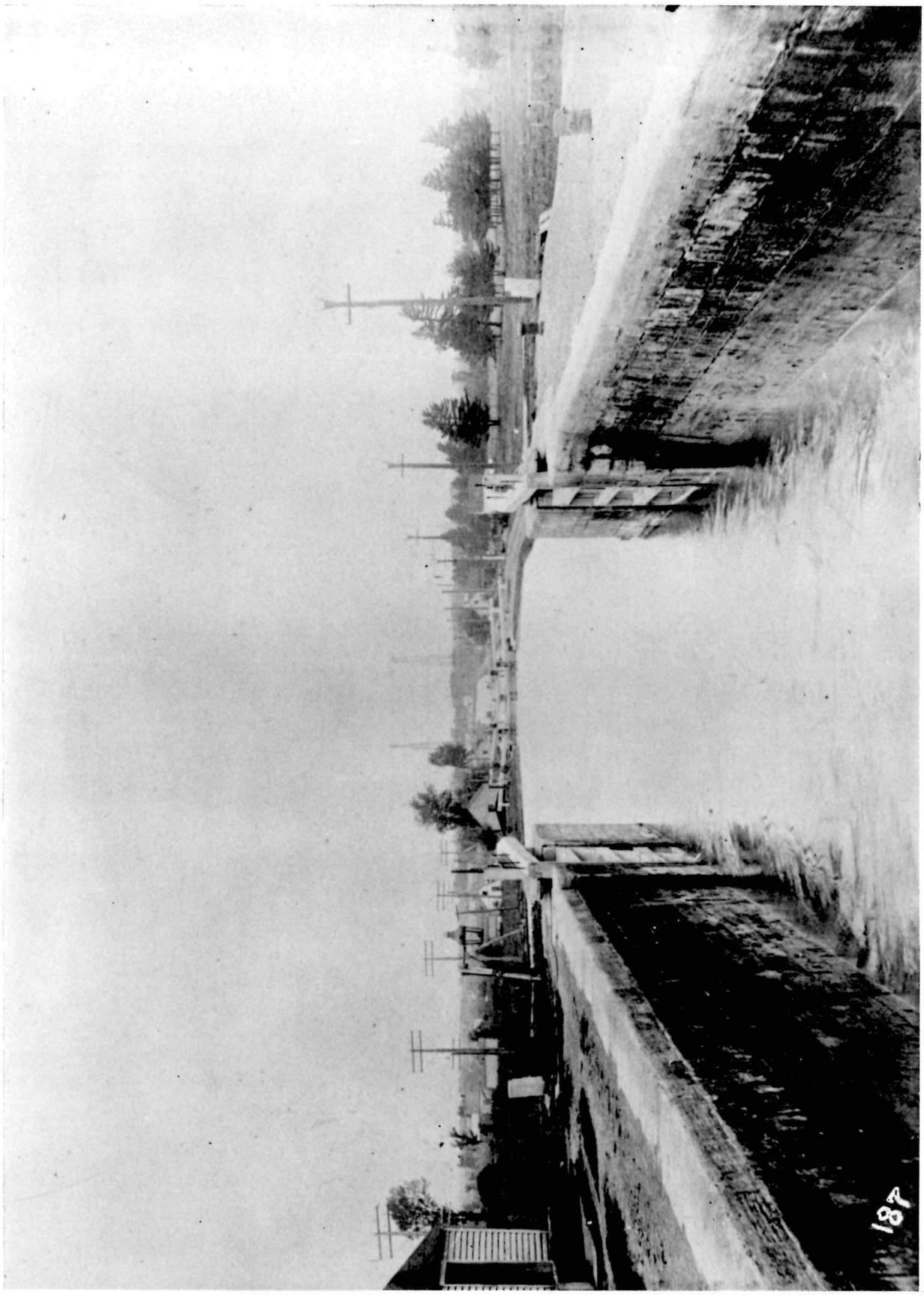
With the exception of the lower east wing wall and all the entrance walls, the walls of lock 6 are substantially as

they were at the end of the 19th century (Fig. 23). Although covered with concrete, much of the masonry breast wall remains as well. Moreover the tests conducted recently by Restoration Services Division have shown that the condition of "the masonry for the retaining walls and counterforts is excellent and solid on both banks of the lock chamber,"[18] certainly a tribute to those who rebuilt the lock almost a century ago.

21 J.E. Doré's plan for the reconstruction of lock 6, ca. 1882. (Quebec Canal Office, Parks Canada, Montreal.)


CANAL CHAMBLY
Ecluse N°4
Elévation Coté Ouest
Elévation Coté Est

22 Lock 6, looking north down the canal, 1904. Note the half-timbered style of the rebuilt chamber walls, the metal sheeting at projecting corners, and the different configurations of the east and west piers above the gates. (Public Archives of Canada.)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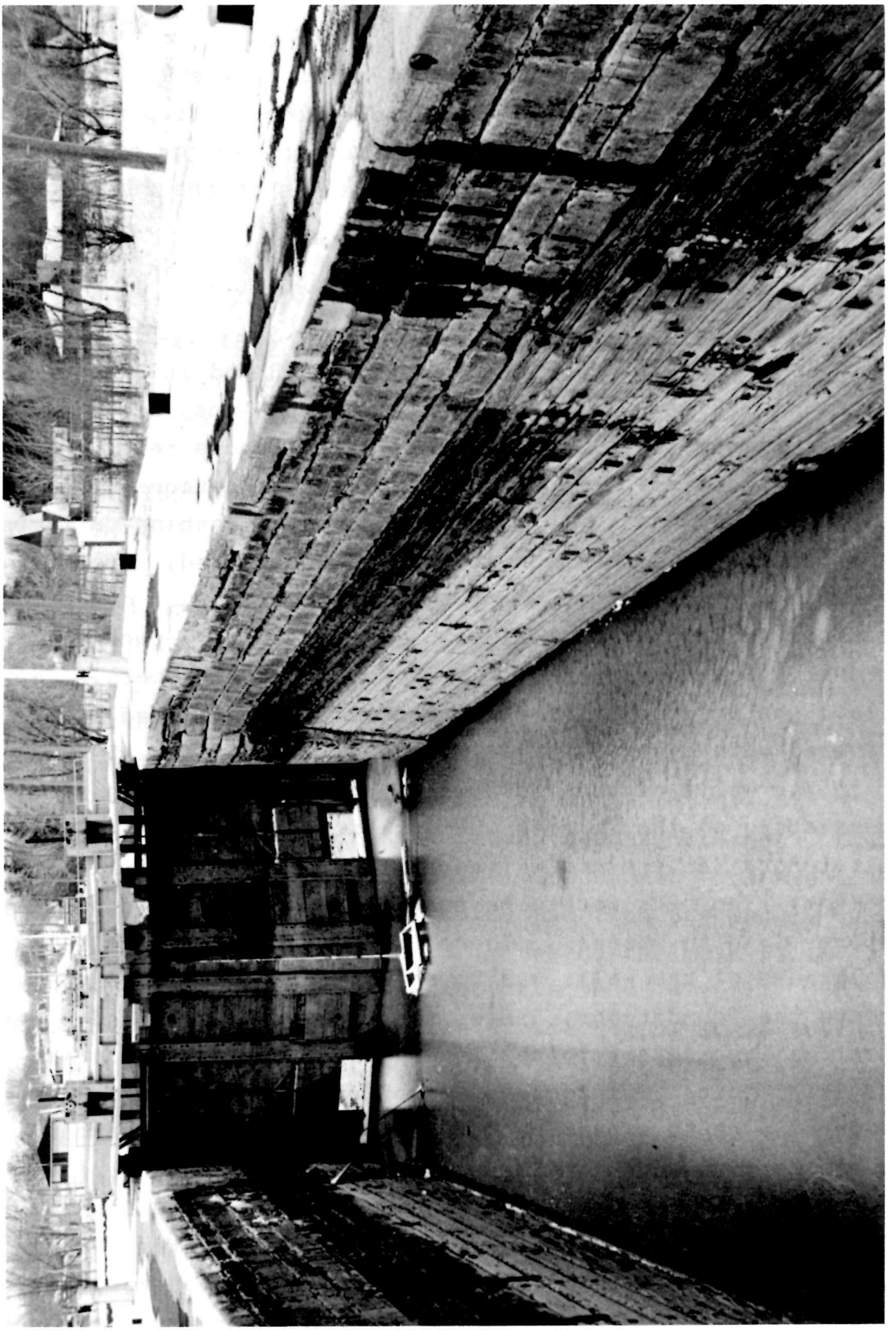
23 The chamber walls in 1973. Today the chamber walls, little disturbed since the rebuilding of the 1880s, are obviously in need of pointing and other maintenance. They were, however, found to be structurally sound in investigations carried out in 1974.



Lock 7

Specifications, 1831 and 1834

Lock 7 was constructed between about 1833 and 1835 under the terms of the 1831 and 1834 contracts (see Apps. B and C). Unfortunately the plans to which the contracts refer have not been located. According to the specifications, the single locks were to be masonry structures resting on timber foundations or on bedrock if conditions allowed. If the engineer found the ground to be unstable he could order the timbers to be placed on piles or 2 feet of well-packed gravel. Gravel was to be placed between the timbers. The floor was to consist of one layer of 3-inch jointed plank covered with a second of 2-inch pine.

The walls of the locks were to be of solid masonry, consisting on the face of well-dressed headers and stretchers (in prescribed proportion) set in hydraulic cement. The back was to be formed "mainly" of 200-pound stones laid in mortar. (There is no mention of rubble.) Thickness of the walls was to be 6 feet for the first 8 feet above the foundations, 5 feet for the next 4 feet and 4 feet for the last 4 feet to the level of the coping, which was to be 2-1/2 feet. Buttresses, spaced every 12 feet and 4 feet square, were to extend back from the rear of the chamber walls to give additional strength to the walls. Oversized buttresses, 8 feet thick at the bottom and 24 feet and 17 feet in length, were to be placed behind the gates, presumably at the upper and lower quoins respectively.

Completed dimensions of the lock chamber were to be 24

by 120 feet. The wing walls were to extend upward from the upper hollow quoins a distance of 22 feet and downstream for 25 feet. The upper wing walls were to project into the banks at right angles a distance of 10 feet and the lower walls 20 feet.

Construction, ca. 1835

How closely the contractors adhered to their contract is difficult to determine in all particulars, although we are able to piece together a brief description of the lock as completed in 1835. (Particularly useful are the plans submitted by F.N. McNamee after his reconstruction of part of the west wall in 1870-71.)

Designed to accomplish a lift of 7 feet 4 inches, the lock was built to the dimensions of about 120 feet 9 inches by 24 feet. Constructed upon a timber foundation supported by piles (both of which went across the entire width of the structure) the free-standing walls were constructed of ashlar masonry. The west wall consisted of 13 courses of masonry on the face. The dressed facing stones obtained from Isle La Motte in Lake Champlain, were backed with stone rubble brought from the Chambly Quarry and from the canal excavations and were laid in mortar. Behind the main walls were at least five cut-stone counterforts about 4 feet square. The thickness of the walls at the bottom seems to have been about 6 feet tapering upward to about 5 feet at the water line. Topping the chamber walls was a course of masonry coping.

An embankment, probably separated from the masonry by a clay puddle trench, was built behind each wall. These embankments were said in 1867 to be 15 feet wide with outside slopes of two to one.

The breast wall of this lock, as for the other locks

completed in the first phase of construction, was built just above the upper gate recess. The upper sill, too, was built of cut stone, while the sill at the lower gate was of oak, to a height of one foot above the foundation. A wooden apron probably extended downstream from the lower sill. The bottom of the lock chamber probably consisted of two layers of thick plank.[1]

Repairs, 1848-56

Like the other locks built in the 1830s, the condition of lock 7 - later said to have been skimpily built with bad materials - deteriorated rapidly. In 1848 the Board of Works reported that the walls required rebuilding.[2] That year the wing walls were puddled (or perhaps repuddled) in an effort to stop the leakage that was undermining the stability of the structure. In the same year the stones in the upper sill, which had been knocked out of position by passing vessels, were secured with clamps. Two years later both sills were displaced and required fixing, a job which was to be done with large iron bolts one inch by 3 feet long secured to the foundation.[3]

As a result of the absence of coping, the wing walls were found in 1850 to be more exposed than formerly to damage from boats when the water in the canal was raised a foot. As a precaution the department completed the job the following year, putting the coping in place and bolting it to the third course below with "fox-wedge bolts" and connecting bars cemented and leaded into holes drilled in the masonry.[4]

Rebuilding was delayed for almost a decade after the call for reconstruction. Meanwhile wooden wedges prevented the facing stones from falling into the lock. The stones at the upper gates, which actually had fallen into the lock,

were re-set and kept in place with planks fixed to the face of the wall by means of long bolts through the wall which were made fast to planks in the rear face.[5]

Reconstruction in Masonry, 1856-59

In 1856 and again in 1859, the upper recess and the lower recess walls were reconstructed, although no details of the project are recorded.[6] The chamber walls were left as they were, with wedges keeping the facing stones in place. Sometime before 1867, the stone mitre sill was taken out and replaced with a wooden one.[7]

Reconstruction in Masonry, 1870-72

By the late 1860s lock 7 was again (or still) in desperate need of more than the usual maintenance. Specifications were issued and tenders called in September 1870 for the reconstruction of part of the west chamber and the upper recess walls, quoins and piers (see App. H). Work was to be done "on the same plan as the present walls," though one foot thicker at the bottom. Contractors were to use hydraulic cement in laying the masonry, of which as much as possible was to be saved from the old walls in the dismantlement. All old stone was to be cleaned before re-use. New stone was to be obtained from Isle La Motte in Vermont. All courses in the reconstructed portions of the walls were to correspond with the courses in the lock which had been left untouched. A ditch 2 to 4 feet wide was to be excavated behind the wall and filled with puddle. (No mention is made in the specifications of whether the counterforts were to be dismantled and rebuilt during the process or whether work was to go on around them.)[8]

The contract for the reconstruction of lock 7, and also

for lock 4 which was to be done at the same time, was given to the firm of F.R. McNamee of Montreal. Work was to be completed by 1 May 1871.

McNamee's estimates for the work performed indicate that only the centre portion of the west wall, for a length of only 6 feet at the bottom and 65 feet along the top 8 courses, was dismantled and rebuilt. (The total number of courses of masonry was 13.) The plans also show the rebuilding of the top 6 to 10 feet of 5 counterforts 4 feet square. It is questionable whether the reconstruction actually followed the government specifications. For example, it is certainly doubtful if the reconstructed portions of the walls were built one foot wider than before, as had been called for in the contract, since most of the reconstruction was on the upper courses of the wall, not at the base where one would logically have to begin any such process. From this, it would seem that the width of the walls as shown in the plan - 6 feet - is the original width. To prevent more problems in future, a French drain was built behind the wall.[9]

Similar work was done on the east wall of the lock the following year. A large portion of the wall was rebuilt with new masonry on the face.[10]

Repairs, 1874-90

Further repairs were required on the lock several years later. In the spring of 1874, the bottom was partially replanked and the walls repaired, though what this involved is not clear. Four years later, some of the projecting stones in the walls were dressed down and the mitre sills repaired. Then, over the winter of 1879-80, the piers below the hollow quoins on the east side were taken down and rebuilt, presumably in stone.[11]

Rebuilding the Lock in Timber and Masonry, 1881-94

During the following decade a series of construction efforts left the west wall of the lock in the timber-masonry style we see today. First to go were the wing wall, the lower recess and part of the lower west wall, which were dismantled in the fall of 1881 and rebuilt the following spring with timber to the water line. Six years later, in 1887, the rest of the west wall was refurbished in this half-timbered style.[12]

No further details of the work completed by 1887 seem to have been recorded. Nevertheless the recent excavations conducted by Restoration Services and the Quebec Canals Office of Parks Canada do provide some information on the rebuilt west wall. The stone masonry was found to be backed with stone rubble set in cement; the rear face of the wall is of smooth cut stone. Several counterforts were also exposed. They were found to be considerably smaller than the original buttresses on the west wall (if McNamee's plans are in fact accurate). The present dimensions - and therefore the 1880s dimensions - are about 1-1/2 by 2 feet. Moreover, a counterfort 1-1/2 feet by 7 feet was discovered at the upper end of the lock, although this may well have been the original wing wall. Further excavation will provide additional information on the reconstruction of the wall.

The problems of the west wall were not solved by the rebuilding program, however. The canal superintendent reported in 1894 that he had had to have 20 holes bored through the walls. Through these he put 21-foot bars 1-1/4 inches thick, which were bolted to heavy timbers placed in a ditch 110 feet long and 18 feet deep, dug behind the wall.[13]

In addition to the west wall, other components of the lock structure required attention during the 1880s. The wooden upper mitre sill and the flooring of the lock were

replaced in the spring of 1884. Then in 1888 the breast wall was taken down and rebuilt.[14] During this period timber cribs filled with stone were placed at the wing walls. Thus, by the end of the decade, the east wall was the only major section of the lock which had not been overhauled. The reconstruction of this wall in masonry in 1872 seems to have held.

Repairs and Partial Modification in Concrete, 1900 to the Present

During the early years of this century work on lock 7 was confined to the sills and bottom of the chamber. During the winters of 1901 and 1902, the wooden sills were taken up, repaired and placed on beds of concrete. Within only a few years, however, the wooden sills were replaced by concrete sills and the floors were covered with that material.[15]

No major work on the lock is again recorded until the Depression years, even though a photograph taken in 1921 indicates that timbers had to be placed across the lock between the wing walls during the winter to keep them from moving inward.

During the 1930s, considerable portions of the lock were rebuilt in concrete. Between 1930 and 1934 the crib and stone entrance walls were taken out and replaced with concrete walls (Fig. 25). About the same time, worn-out timbers on the west wall were replaced and the lower west wing was faced with concrete.[16] Then in 1935 part of the west wall at the upper gates was repaired, also with concrete. On the east side, the top courses of masonry of the chamber wall at the lower end which had been leaning inward were rebuilt and the adjoining "splay" wall straightened.[17]

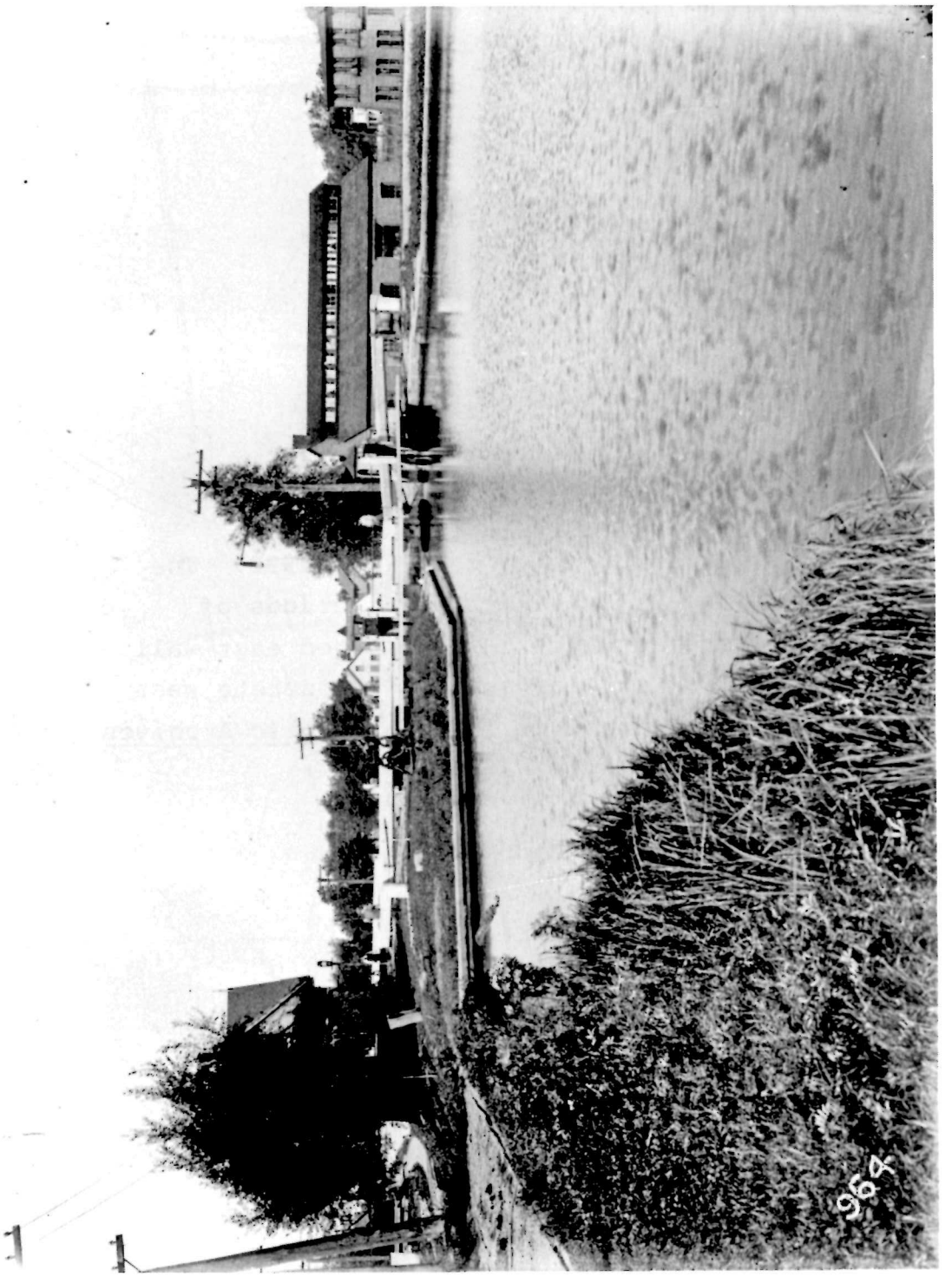
Between 1935 and 1937, the east wall, reconstructed 65

years previously in masonry, was taken down for a distance of 50 feet at each end and rebuilt in concrete. The lower east entrance wall, which had been forced out of line, was anchored with tie rods.[18] Ten years later, this wall was rebuilt, again in concrete. In 1955, the lower west entrance wall was refaced with concrete.[19]

The Lock Today

Today, only the centre portions of the chamber walls remain as they were built in the last century, the east wall as it was rebuilt in solid masonry in the early 1870s and the west wall in timber and masonry a decade later. In addition, the bottom portion of the original masonry breast wall has survived. The rest of the structure - the lower wing walls, recesses and the ends of chamber walls, in addition to the bottom of the lock - are concrete. Indeed the upper wing walls seem to have been taken out entirely in the demolition work of the 1930s.

24 The upper entrance to lock 7 in 1911.
(Public Archive of Canada.)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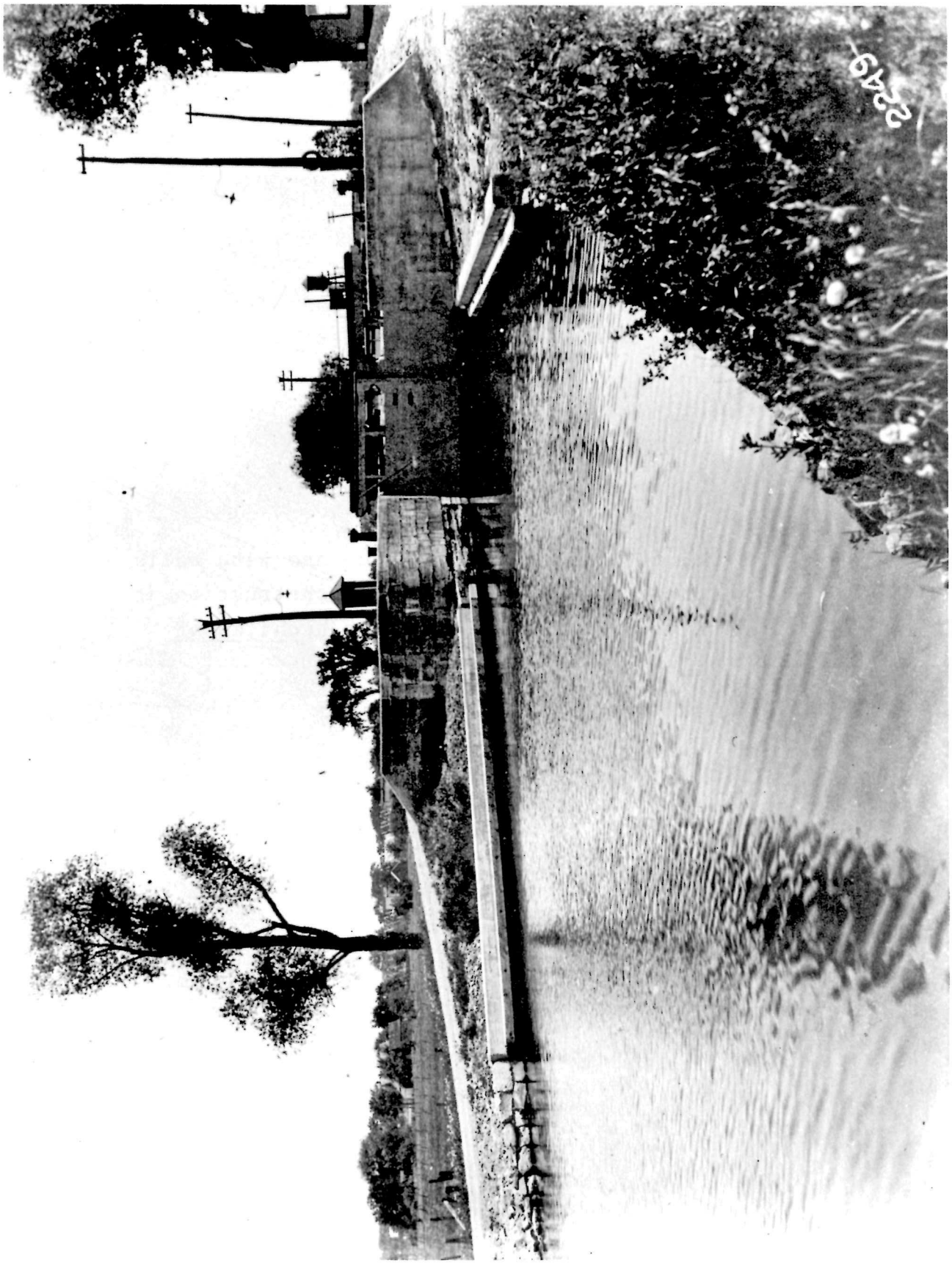
25 The lower entrance to lock 7 in 1933. The lower wing walls reflect two periods of reconstruction, the half-timbered east wall dating from the 1880s and the concrete west side dating from the 1930s. (Public Archives of Canada.)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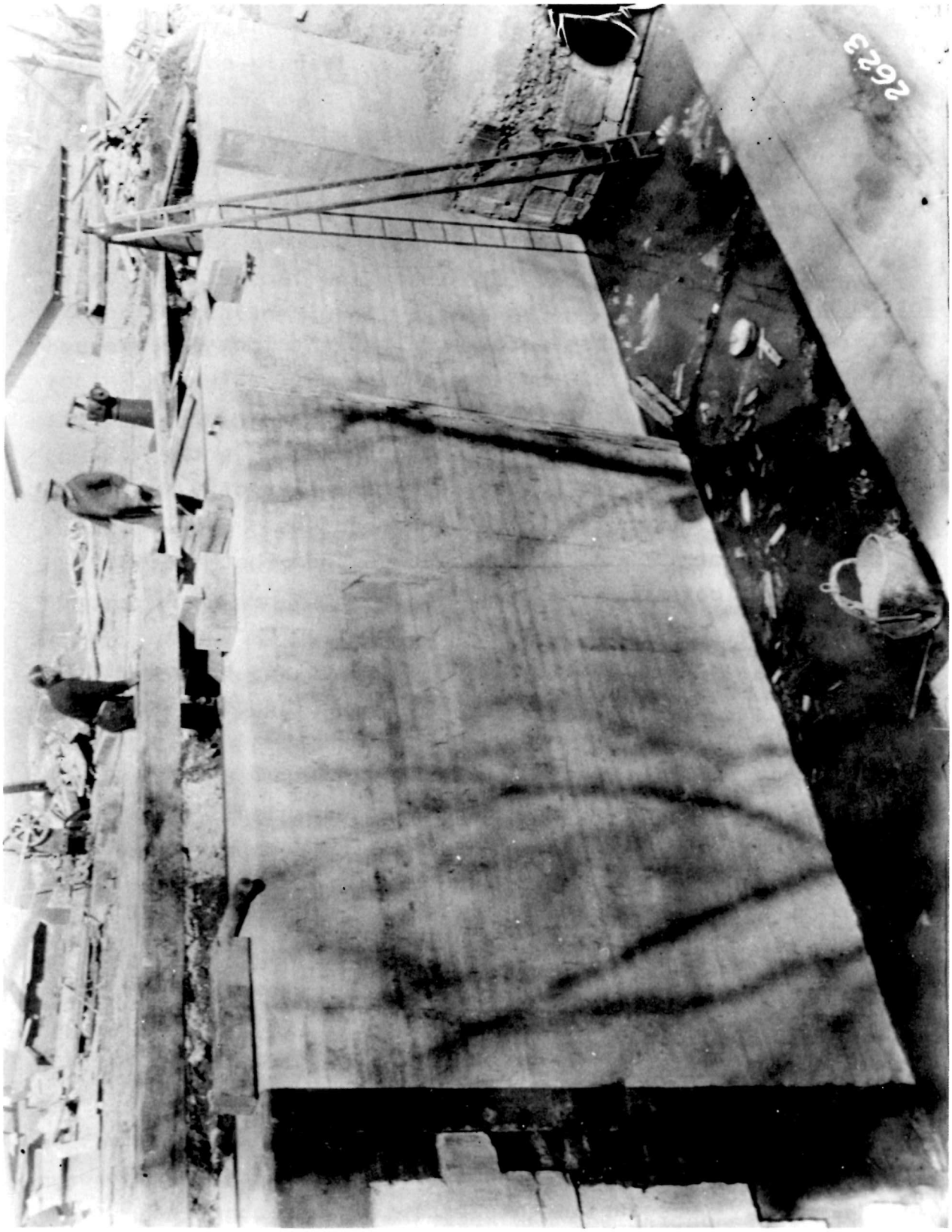
26 The upper east chamber, recess and wing walls of lock 7 in the process of reconstruction in concrete during 1937. (Public Archives of Canada.)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Lock 8

Introduction

The first lock to be constructed, the present lock 8,[1] was completed in November 1833 and opened to traffic in the spring of 1834. Then known as Macrae's lock, or lock 1, it was built to the original dimensions authorized in the 1823 Act - 100 feet long by 20 feet wide with a lift of 9 feet.[2] It was the only lock built to these dimensions. Even before the completion of lock 8, it had been decided that the Chambly Canal locks were to be 120 by 24 feet. Specifications for larger locks were drawn up by the engineer William R. Hopkins and the contract was signed with the contractors in July 1834 (see App. C). The contractors Samuel and Stephen R. Andres may have begun the dismantlement and enlargement of lock 8 in late 1834 or early 1835 before work on the canal was suspended.[3] New specifications were drawn up in 1841 for the contractors Lauder, Whitlaw and Tennant (see App. E) and the enlargement of the lock was completed by the opening of navigation in the spring of 1843.

Specifications, 1831

The specifications for the construction of the locks were included in the contract signed 5 September 1831 (see App. B). Although they are often vague and at times confusing (as was usually the case in this era) they nevertheless provide a relatively clear outline of the lock structure

envisaged by the commissioners and the engineer W.R. Hopkins. The plans to which the contract refers have not been located.

According to the specifications, the contractors were to build a masonry lock on a flatted timber foundation or on the bedrock if circumstances permitted. If the ground appeared soft and unstable the engineer could order that piles or 2 feet of well-packed gravel be placed below the timber foundation. Well-rammed gravel was to be placed between timbers. Dimensions of the lock chamber were to be 100 by 20 feet. (The lift of each lock was not specified and was probably left to the discretion of the engineer on the site.) Wing walls were to extend upward from the upper hollow quoins a distance of 18 feet and downward from the lower quoin a distance of 25 feet, and then to project into the banks at right angles a distance of 10 and 20 feet respectively. The width of the masonry walls was to be 5 feet 6 inches at the bottom for a distance upward of 6 feet, 4 feet 9 inches for the next 4 feet and 4 feet for the remaining distance up to the level of the coping, which was to be 2 feet 6 inches wide. The face of the walls was to consist of headers and stretchers in prescribed proportion, set in hydraulic cement, while the backing was to be formed "mainly" of 200-pound stones laid in mortar. (There is no mention of rubble.)

The main walls were to be strengthened as far as the top water-line by a number of 4-foot square buttresses placed 12 feet apart and bound into the main wall by headers. Behind each of the upper gates, presumably extending back from the quoins, there was to be a long buttress 24 feet in length and 8 feet in width, while those at the lower gates were to measure 17 by 8 feet. The curved masonry breast wall above the upper gate was to be 5 feet thick, run the width of the lock and the height required by

the lift of the lock.

Rows of sheet piling, spiked to the foundations and surrounded by puddling, were to be placed at the head and foot of the lock and at the lower quoins. The floor was to consist of a layer of 3-inch jointed plank topped with a second layer of 2-inch pine plank secured to the foundation timbers with tree-nails and spikes respectively. The design for the mitre sills was left to the discretion of the engineer, although it was specified that the sill was to be secured to the foundation timbers with six wrought iron bolts 2 feet long and one inch in diameter.

Construction, 1833

Precisely how closely the lock structure, as completed in November 1833, resembled the 1831 specifications cannot be determined from the documentation now available. We can say with certainty that the walls were built of masonry on a timber foundation, and topped with a course of coping laid in cement. The base of the lock seems to have been slate.[4] The smooth dressed stone for the facing had been brought in blocks by scow from Isle La Motte in Lake Champlain and dressed near the construction site, probably at St. Jean. The backing stone was acquired locally. In their report in November 1833 the canal commissioners noted the high quality of the masonry which was executed, they said, almost entirely by Canadians.[5]

The thickness of the main walls as built is not recorded, although it was obviously less than 6 feet at the bottom and the average was less than 5-1/2 feet, a size which J.B. Jervis (an eminent American engineer hired in July 1833 to make an independent examination of the works) considered the minimum size compatible with stability. Jervis reported that the walls then specified - and

presumably under construction at Macrae's - were "too light."[6] He proposed that the thickness of the walls be increased, an improvement which would require 140 perches of backing at a cost of £70 per lock. It is doubtful that Jervis's advice was heeded, for the construction of lock 8 was then well under way and the contractors displayed an unwillingness to accept changes not specified in the contract. (Nevertheless Jervis's suggestions were incorporated in the specifications in the contract for enlargement the following year.) We also know that masonry counterforts were placed behind the main walls and that the breast wall was also built in masonry, although whether to specification is not documented.

The bottom of the structure was plank, tree-nailed and spiked to the timber foundation. At the bottom of the excavation at the head of the lock there was, according to Jervis, a wooden "platform" protected by sheet piling and puddling to prevent water from seeping through the foundation.[7]

Enlargement Specifications, 1834

As mentioned above, a contract was signed in July 1834 for the construction of the locks on a larger scale than originally stipulated. It specified that the work was to proceed according to the 1831 contract except for the stated changes. Briefly, the chambers were now to have dimensions of 25 by 120 feet; the upper wing walls were to measure 22 feet from the upper quoins and the lower 25 feet from the lower quoins. The width of the walls was also enlarged, to 6 feet thick for the first 8 feet, 5 feet for the next 4 feet, and 5 feet thick for the next 4 feet in height. (For further details, see App. C.)

Enlargement, 1834-35

Precisely how far the contractors had proceeded with the enlargement of lock 8 before the construction of the canal ceased in 1835 is not recorded. Included in the Andres' statement of extra work on the canal, dated 1 October 1835, are claims for 1,000 feet of timber and 500 yards of excavation in slate for the "extra width" of "lock 1" (see App. D). Certainly the Andres' claims imply that they had dismantled the lock and had begun the enlargement in 1835. Yet the specifications drawn up for the enlargement of the lock in July 1840 imply that the lock had been left intact in its original dimensions (see App. E). Precisely what was the case cannot be determined.

Orders to Enlarge, 1842

About June 1842, the canal engineer, George Keefer, directed the contractor, Lauder, Whitlaw and Tennant, who were then well along in their work on the combined locks, to rebuild the small lock, formerly Macrae's and now known as Dubuc's, on the revised scale to correspond to the others.[8]

Specifications, 1840

Partial specifications for the enlargement of the lock had been included in the specifications for the combined locks, drawn up in July 1840 (see App. E). According to the specifications, the timber foundations already in place were to be reused if possible. The masonry in the lock (which Keefer referred to as lock 1) was to be the same as for the combined locks - that is, ashlar masonry at the face backed with rubble to a width of 8 feet at the bottom tapering to 5 feet at the top. Five counterforts, 4 feet by 4 feet, were to give extra support to the walls. To what other extent

the lock was to resemble the combined locks constructed by Lauder, Whitlaw and Tennant or the locks built according to the 1831 and 1834 contracts is left unstated.

Enlargement, 1842

The contractors accordingly built their dams and began dismantling the lock in August 1842. That done, the excavation to enlarge the lock pit proceeded quickly; only 2,032 square feet required to be moved. The laying of the masonry, however, was retarded by the fact that much of the stone from the original work, which had been obtained from a local quarry, had crumbled and cracked during the dismantlement; consequently, more new stone from Vermont was required than had been anticipated. Nevertheless, by late November 1842 all the stone work - grouted with hot lime - was finished, with the exception of dressing the hollow quoins, pointing the coping and hanging the gates. These final touches were completed well before the scheduled opening of the canal in the spring of 1843.

The Lock as Built, 1842

Although it had been expected that the old foundation timbers would have to be taken up and relaid, they were found in fact to be "quite firm and solid." As a result the new enlarged lock structure was constructed upon the original foundation, which was found to be wide enough to support the extra 4 feet in width. Twenty feet of foundation had to be added at the lower end to accommodate the new length of 126 feet. The 6-inch spruce piles recorded in the contractor's "list of materials used" were probably driven into this new section of the lockpit.

"Pitching" or "paving" (possibly tar) was also used in the bottom of the lock, apparently as a sealer in place of puddle or concrete between the timbers. The floor consisted of 2- and 3-inch planking, probably one layer of each.[9]

Built of ashlar masonry with a rubble backing, the chamber walls were supported by all-masonry counterforts. The "circular" or wing walls and the breast wall, built in connection with the mitre sill at the upper gates, were also of masonry supported by piles and protected by sheeting piles. Grooves were built into the upper wing walls for the reception of oak stop logs. (In addition to their function in the lock structure, the upper wing walls also served as the abutments for a rolling bridge.) Long bolts seem to have been put down through the courses of masonry in the breast wall and coping, and leaded in place to give added stability.[10]

The lower mitre sill was made of pieces of oak timber held together and fixed to the bottom of the lock with iron bolts. A wooden apron was probably placed below the lower mitre sill.

Wall sluices leading from the upper end of the lock in the recess to just below the gates provided the water supply for the lock. At the lower end the sluices were in the gates.

Although Keefer referred to the width of the lock as 24 feet, it was reported in 1867 as 23 feet 3 inches wide.[11] This discrepancy may be attributable to the inward movement of the walls over a period of years.

Maintenance and Repairs, 1843-57

Lock 8, like all the other locks in the Chambly Canal system, began to leak almost immediately after its

completion on an enlarged scale. In the fall of 1848 the wing walls were puddled in an attempt to solve the problem.[12] Several years later timber fenders were placed on these walls to prevent damage to the masonry from the heavy boats passing through the lock.[13]

Despite these efforts the condition of the lock continued to deteriorate to such a degree that John Page, the engineer for the Quebec canals, ventured an opinion in 1852 that the lock would last for only a year or two at most until about 50 feet of one of the walls at the head of the lock were rebuilt. The next year Page again reported on the poor condition of the lock. He stated that the mortar in the upper recess, in the breast wall and in about 30 feet of the chamber wall below the gates had been washed away from the face at least, and that damage might be still more extensive. The Board of Works, hesitating to spend the necessary money, made only a few temporary repairs to the breast wall and mitre sill.[14]

Partial Reconstruction in Masonry, 1858-81

By 1858 major work could be put off no longer without risking the collapse of the lock and thus the breakdown of the whole 12-mile canal system. That spring the upper wing, recess and breast walls were taken down and rebuilt.[15] During the following winter the lower wing and recess walls were reconstructed. The chamber walls, although continuing to leak badly, were left as they were, and the facing stones kept from falling inward by wedges of wood driven between the stones.[16] Indeed, with the exception of the periodic replacement of the fender timbers and repointing, lock 8 received little attention for the next 15 years.

By 1873 major reconstruction work was again

unavoidable. That spring the lower wing wall on the east side was taken down and rebuilt. During the following year the east chamber wall, which was leaking badly and in serious danger of falling in, was also reconstructed with new facing stones where required. The lock bottom was partially replanked at the same time. Then over the winter of 1879-80 the upper parts of the wing walls at the lower end of the lock were dismantled and rebuilt. The following year the mitre sill - whether upper or lowr is not known - was "renewed".[17]

Rebuilding the Lock in Timber and Masonry, 1882-95

During the 1880s lock 8 (from the little documentary evidence available) seems to have been almost entirely rebuilt in the timber and masonry style. The first section to be done was the lower east wing wall, which in December 1881 was taken down to the foundations. It was rebuilt the following spring in timber to the level of the canal water and in masonry above. (J.E. Doré's plan of 1882 had proposed the rebuilding of the east wall entirely in timber; once again his plan seems to have been ignored. See Fig. 27.) It was reported as well that the walls of this and other locks were at this time protected by cribs filled with stone placed below the wings.[18]

Two years later the Department of Railways and Canals reported that the upper wing and recess walls and part of the chamber walls were taken down and rebuilt in the "same manner as was adopted for the lower end of [this lock] two years ago. The lower courses, from foundation to water level, being constructed of timber, backed with concrete, and the upper portion, above water line, being built of ashlar masonry." (In fact nowhere in the records had there been reference to work on more than the lower east wing

wall, but the later statement implies the rebuilding of both lower wing walls.) A new upper mitre sill, perhaps in stone but probably timber, had been built at the same time.

In 1894-95 the department reported that a portion of a wall had been rebuilt, although what wall and in what manner is unfortunately not clear.[19] The departmental records on the construction are incomplete and misleading in their generalizations. Our only other source of information is photographic. Unfortunately the earliest photographs of the lock, taken in 1904 and 1911 (Fig. 28), are not very useful. In fact the most informative pictures of the lock were taken during the dismantlement of the west wall in 1966-67, 80 years later. Despite the long time lag, it is probably safe to assume that the timber and masonry lock walls as they were found in the 1960s were essentially as they were rebuilt in the 1880s.

The recent photographs show the chamber walls of the lock, but not the wing walls (see Figs. 29, 30 and 31). What is clear is that the upper east chamber wall to a distance of about 10 feet above the lower gates had been rebuilt in timber and masonry, while the remainder remained masonry from the top to the bottom of the lock. The west chamber wall was built in the half-timbered style except for an all-masonry section just below the upper gate. When demolished in 1966-67 the timber portion of the west wall proved to be different from that on other locks; lock 6, for example, consists of courses of timbers backed with rubble and masonry counterforts. The thick plank facing of the west chamber wall of lock 8 was found to be backed only with clay. It is certainly surprising that this wall was able to stand as long as it did. How the bolts leading back from the face of the planking were secured cannot be ascertained from the photographs available, nor do the pictures show evidence of the 10-inch wall of concrete poured in the rear

of the wall as reported by the department in 1914, suggesting that the concrete must have been washed away.[20]

Maintenance and Modification, 1895 to the Present

After the work done in the 1880s and 1890s, lock 8 seems not to have required major repairs for more than a decade. The repairs made since then have largely been done in concrete.

In the spring of 1908 the lock received a new concrete sill, probably at the upper end. Four years later the planking in the bottom of the lock was removed and replaced by a concrete floor. Then in 1914, as mentioned earlier, a trench was dug behind the west wall for its entire length and a 10-inch thick wall of concrete placed there to make the wall watertight.[21]

In the mid-1920s further repairs in "reinforced concrete" were made to the top of the breast wall, the bottom of the lock and the lower apron.[22]

Work on the lock during the Depression years was confined to the renewal of the timber facing on the upper entrance walls.[23]

Since World War II the lock has been considerably modified. The west chamber wall of the lock was taken down and rebuilt in concrete during the winter of 1966-67.[24] Sometime later, the rest of the west side was rebuilt in similar fashion, although the precise date of the work was not recorded in the annual reports.

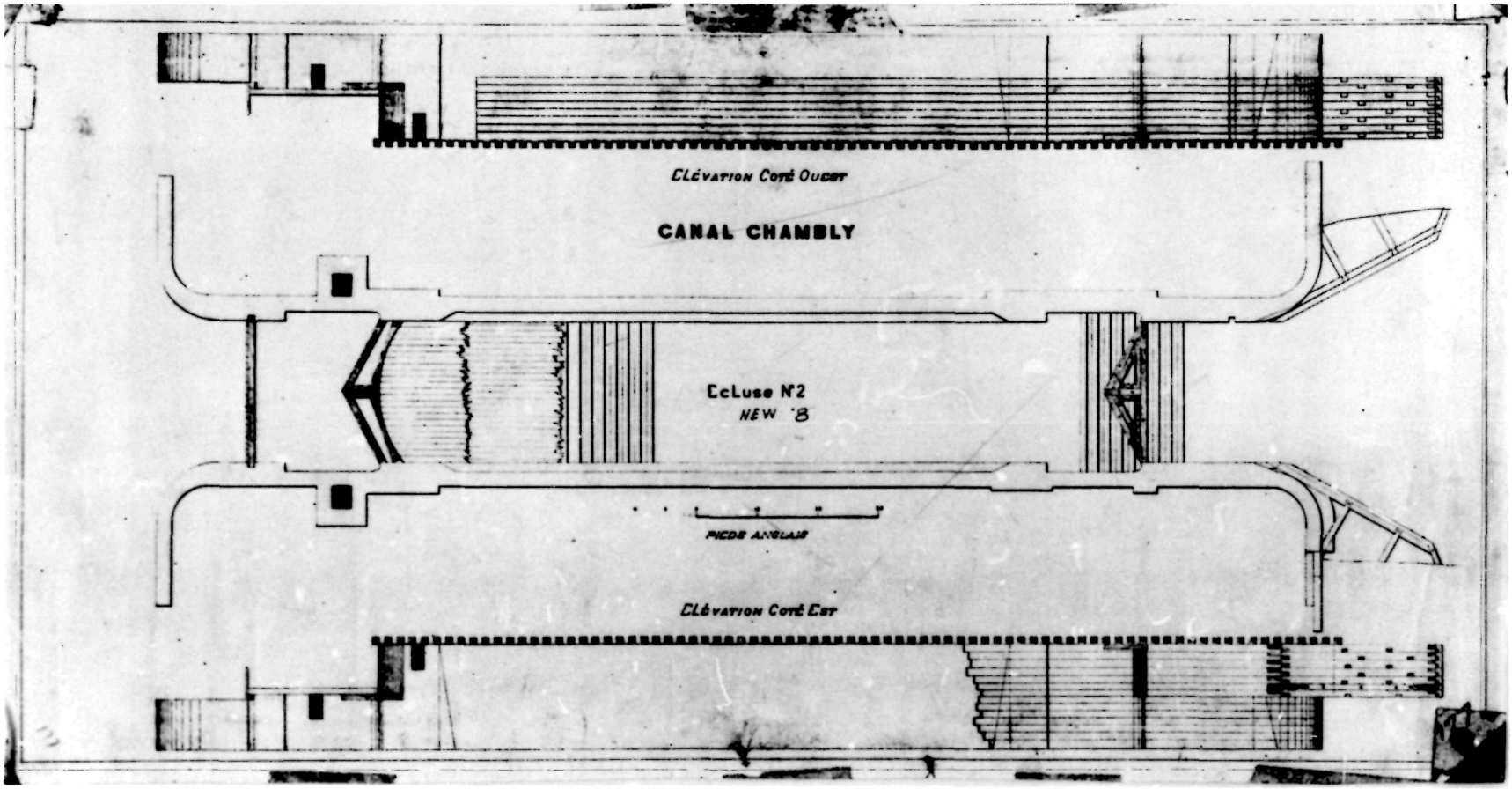
The Lock Today

What we have today is a lock much changed from its original and its 19th-century rebuilt form. The entire west side of the lock as well as the entrance and wing walls on the east side and the lock bottom were rebuilt in concrete in 1967 (Fig. 32). What remains of the historic lock is only the

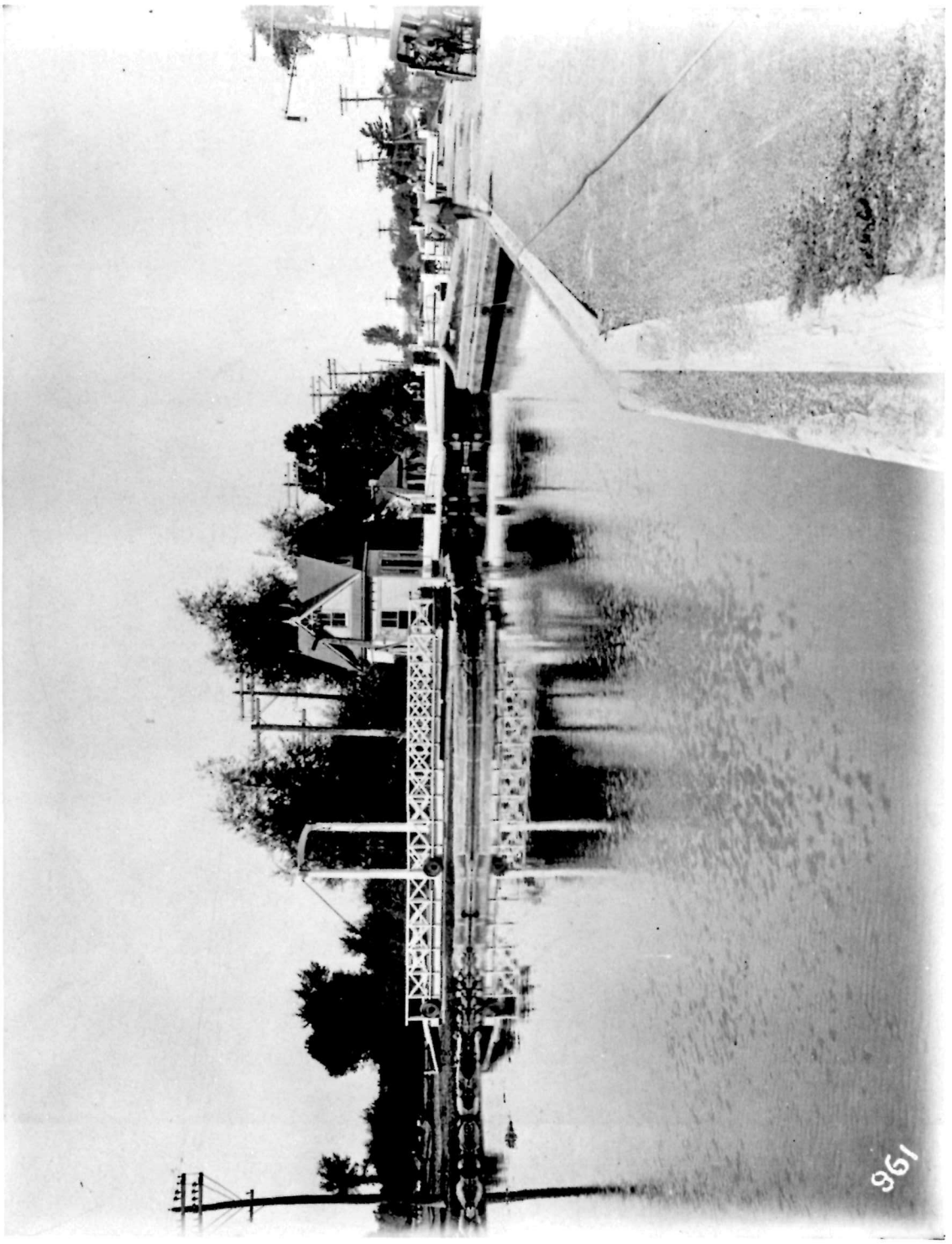
east chamber wall as it was rebuilt in timber and masonry, though the masonry - particularly at the lower gate - has deteriorated badly on the face.

During the winter of 1974-75 the Quebec Regional Office of Parks Canada undertook major stabilization and reconstruction work on the east side of lock 8. Grout was injected into the chamber wall from the rear and the facing stones were repointed. Badly damaged masonry was replaced with new. The chamber wall was stabilized in the rear by a wall of reinforced concrete resting on bedrock. The lower east recess wall was taken down and replaced by a reinforced concrete wall with a masonry façade consisting of salvaged stone.

27 J.E. Doré's plan for the reconstruction of lock 8, ca. 1882. (Quebec Canal Office, Parks Canada, Montreal.)


ELÉVATION COTÉ OUEST
CANAL CHAMBLY
Ecluse N°2
NEW 8
PIEDS ANGLAIS
ELÉVATION COTÉ EST

28 The upper entrance to lock 8 in 1911. The upper wing walls serve also as the abutments for the rolling bridge which allows traffic to cross the canal at this point. Note the rack and pinions just above the gates which control the flow of water through the wall sluices. (Public Archives of Canada.)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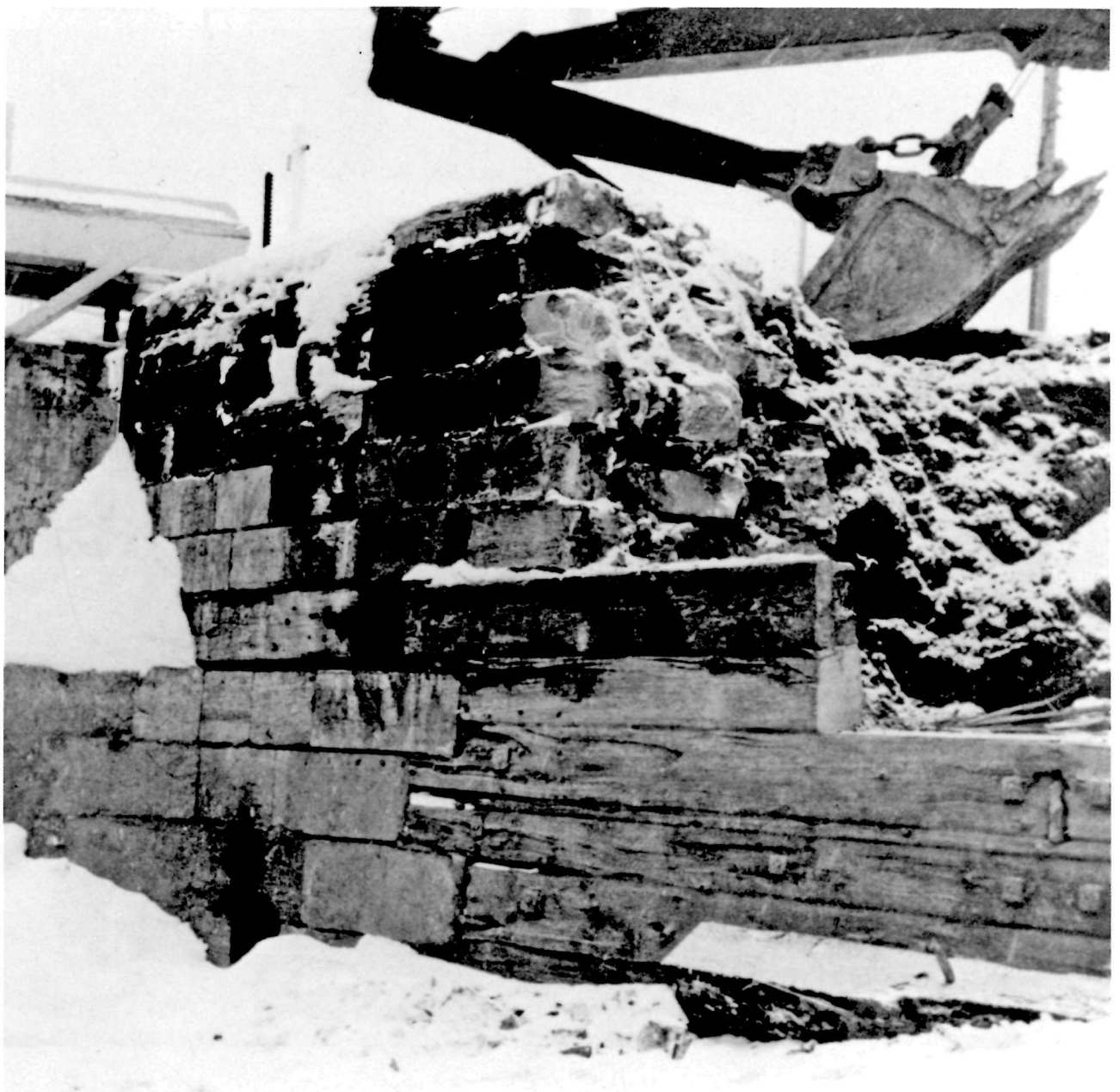
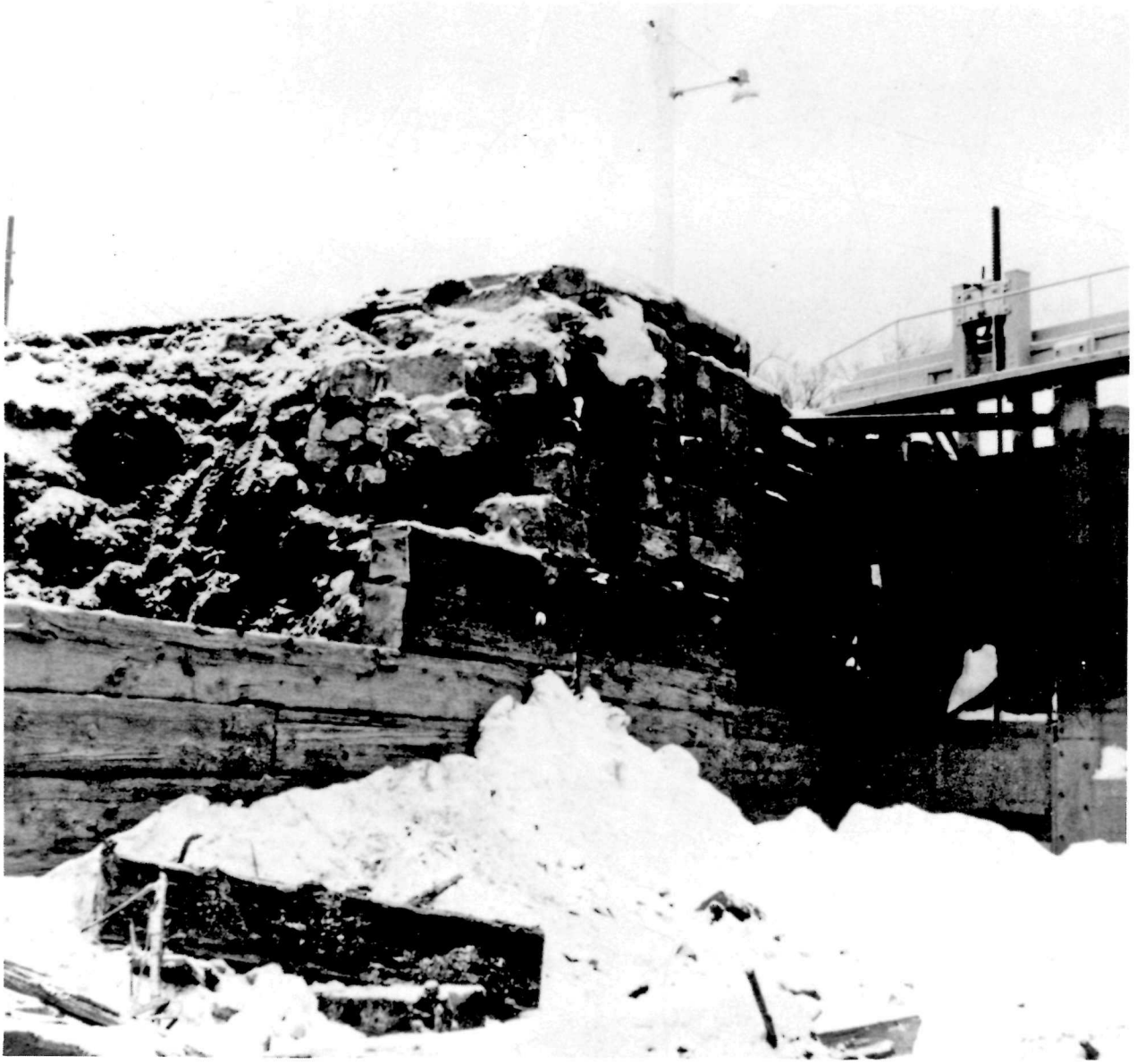
29 Demolition of the west chamber wall of lock 8, looking south, 1967. Clearly the timber portion of the wall consisted only of thick planking backed with earth fill. That the wall stood as long as it did is remarkable. Note that the east wall at the gates is masonry from the bottom of the lock to the coping. (Engineering and Architecture Branch, Department of Indian and Northern Affairs, Ottawa.)

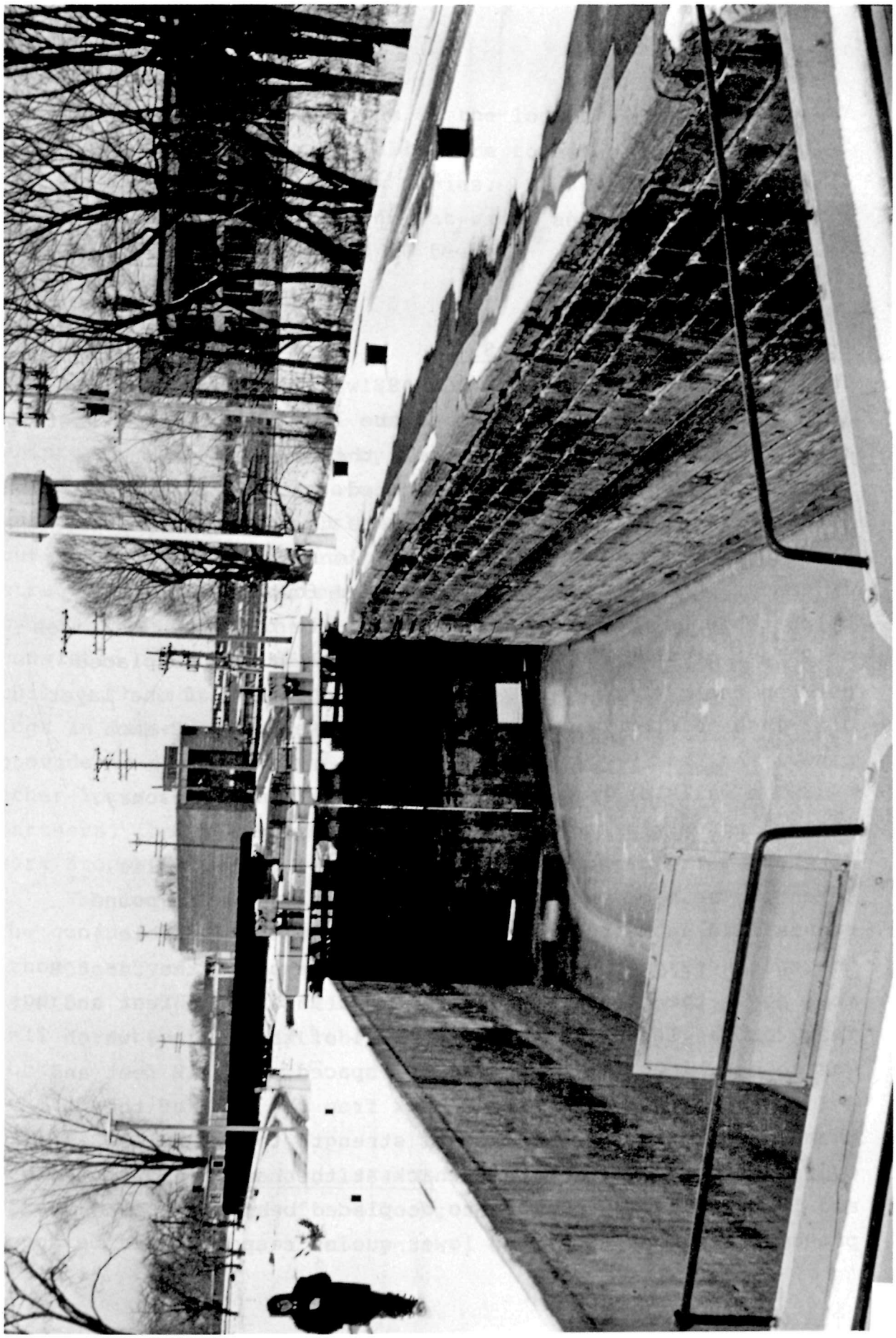
30 Demolition of the west wall at the upper gate in 1967. Note that the wall at the gates was not reconstructed in the half-timbered style but remained masonry from the bottom of the lock to the coping. (Engineering and Architecture Branch, Department of Indian and Northern Affairs, Ottawa.)



31 Demolition of the west wall of lock 8 at the lower gates. (Engineering and Architecture Branch, Department of Indian and Northern Affairs, Ottawa.)



32 Lock 8, looking north from the lower gates in 1973. Here the concrete wall of the 1960s faces the timber and masonry wall as it was in 1973, little changed (or maintained) since its reconstruction in the 1880s. Recently the latter was excavated and examined. The chamber wall was stabilized with a reinforced concrete wall in the rear, re-grouted and pointed; the lower gate recess was dismantled and rebuilt in concrete with an original stone façade. (Engineering and Architectural Branch, Department of Indian and Northern Affairs, Ottawa.)



Lock 9

Specifications, 1831 and 1834

The guard lock, the present lock 9, was constructed between 1833 and 1834 under the terms of the 1831 and 1834 contracts (see App. B and C). Unfortunately the plans to which the contracts refer have not been located. According to the specifications, the single locks were to be masonry structures resting on timber foundations or on the bedrock if conditions allowed. If the engineer found the ground to be unstable he could order the timbers to be placed on piles or 2 feet of well-packed gravel. Gravel was to be placed between the timbers. The floor was to consist of one layer of 3-inch jointed plank covered with a second of 2-inch pine.

The walls of the locks were to be of solid masonry, consisting on the face of well-dressed headers and stretchers (in prescribed proportion) set in hydraulic cement. The back was to be formed "mainly" of 200-pound stones laid in mortar. (There is no mention of rubble.) The thickness of the walls was to be 6 feet for the first 8 feet above the foundations, 5 feet for the next 4 feet and 4 feet for the last 4 feet to the level of the coping, which was to be 2-1/2 feet. Buttresses, spaced every 12 feet and 4 feet square, were to extend back from the rear of the chamber walls to give additional strength to the walls. Oversized buttresses, 8 feet thick at the bottom and 24 feet and 17 feet in length, were to be placed behind the gates, presumably at the upper and lower quoins respectively.

The completed dimensions of the lock chamber were to be 24 by 120 feet. The wing walls were to extend 22 feet above and 25 feet below the hollow quoins. The upper wing walls were to project into the banks at right angles a distance of 10 feet and the lower walls 20 feet.

Construction, 1834

Finished in the summer of 1834, the guard lock at St. Jean was the second lock to be completed and the first on the new enlarged scale authorized by the legislature the previous year (Fig. 33). The face of the lock was constructed of cut-stone masonry from Isle La Motte with a rubble and cut-stone backing and stone counterforts at the rear. The structure probably rested on a timber foundation supported by piles like the other locks. The floor of the lock consisted of longitudinal planks. The upper wing walls were built with grooves on the face for the placement of stop logs in order to be able to drain the lock for repairs or to provide an emergency dam should the gates fail. Like the other locks built in the 1830s by the Andreses and their partners, the coping was left off the wing walls when the work stopped in 1835.

The lock chamber was about 120 feet 7 inches between the quoins, 24 feet wide and 7 feet on the mitre sill (though only 6 had been specified). Both mitre sills were reported in 1867 to be timber, although the upper sill may well have been stone at the beginning as with the other locks.[1]

Repairs and Maintenance, 1834-73

After the completion of the lock, the commissioners proudly reported that it was a substantial, well-executed piece of

work. While one might well expect such self-congratulations from men whose duty it was to oversee the work and on whom ultimate responsibility for the quality of the work devolved, lock 9 does indeed seem to have been a well-built structure. Certainly it does not seem to have fallen into dilapidation as quickly as the succeeding locks built by the first contractors on the canal. While some of those locks seemed ready to fall down by 1848, the guard lock required only the masonry in the wing walls to be reset and clamped in 1848 and the coping on the wing walls completed several years later.[2]

By 1861, however, the lock was in poor condition. That year it was recorded that the upper wing and recess walls were in an "insecure state". There is no record of any immediate measures taken to improve their condition.[3]

Reconstruction in Masonry, 1873-85

During the decade of the 1870s, parts of the lock were reconstructed in masonry, as they had been before. Between 1873 and 1875 the lower wing walls were rebuilt in this manner. At about the same time the chamber walls and the upper wing walls were repaired, although precisely what this involved is not recorded. Further repairs to the walls were made in early 1879, including relaying portions of the masonry, trimming projecting facing stones, grouting and pointing with cement. It was also reported that the lock, like many of the others, had to be braced with timber in the fall to prevent the walls from being pushed inward by the action of frost. Several years later the upper wing walls were given protection by two crib walls covered with plank, which prevented boats from crashing headlong into the masonry (see Figs. 33 and 34).[4]

The timber braces did not prove sufficient to prevent

the shifting of the walls. In April 1883, 30 feet of the wall on the east side, which was in danger of collapsing, had to be taken down and reconstructed. During the following July similar treatment was required and hastily executed on portions of the upper wing walls.[5] Nowhere is there mention that the reconstruction was done in timber and masonry; one consequently assumes that the work was done only in masonry.

Rebuilding the Lock in Timber and Masonry, 1886-88

The work done on the lock in the early 1880s had been done hastily in piecemeal fashion to meet emergencies. Then, between 1886 and 1888, the lock was entirely rebuilt, in timber with a concrete backing to a height of 7 feet above the bottom of the lock and in masonry above. The first to be rebuilt were the lower wing and recess walls and the abutments for a combined distance of 80 feet on both sides of the lock in 1886, the bottom 7 feet in timber with a concrete backing, the upper portion in ashlar masonry set in cement mortar. In 1888 the rest of the lock up to the wing walls was rebuilt (see Fig. 35). The two wooden guide piers at the upper entrance were also rebuilt.[6]

Repairs, 1899-1900

No work on the guard lock is again recorded until 1899. That autumn a coffer-dam was built above the lock to drain it. The bottom was then cleaned and partially replanked. The sills too were taken up and repaired.[7] These are the first recorded repairs to the bottom of the lock since its construction in 1834, not, perhaps, because the repairs were not required earlier, but probably because canal authorities avoided doing them due to the difficulties of completely

draining the uppermost lock in the system.

Repairs and Modification in Concrete, 1923 to the Present

The next recorded work on the lock again involved the bottom. In 1923 the floor and the sills were "renewed" in concrete,[8] which means that concrete was probably poured over the plank that was already there. Then in 1934 the lower approach walls were rebuilt in concrete. In the following year it was reported that the "splay" walls which had been rebuilt in concrete the year before - presumably the entrance walls - had been backfilled and extended at each end with a dry masonry wall 25 feet long and 7 feet high. It was reported, however, in 1936 that a masonry wall 25 feet long and 7 feet high had been built below the lock on the east side of the canal.[9] It may have been that the work was spread over two years. At the end of the decade the worn-out timber facing on the upper entrance walls was replaced with new timber.[10]

After the Depression years few structural changes were made to lock 9 until the late 1960s, when the poor condition of the west wall necessitated action. The masonry and timber, placed there in 1888, were removed and the entire wall rebuilt in concrete.

The Lock Today

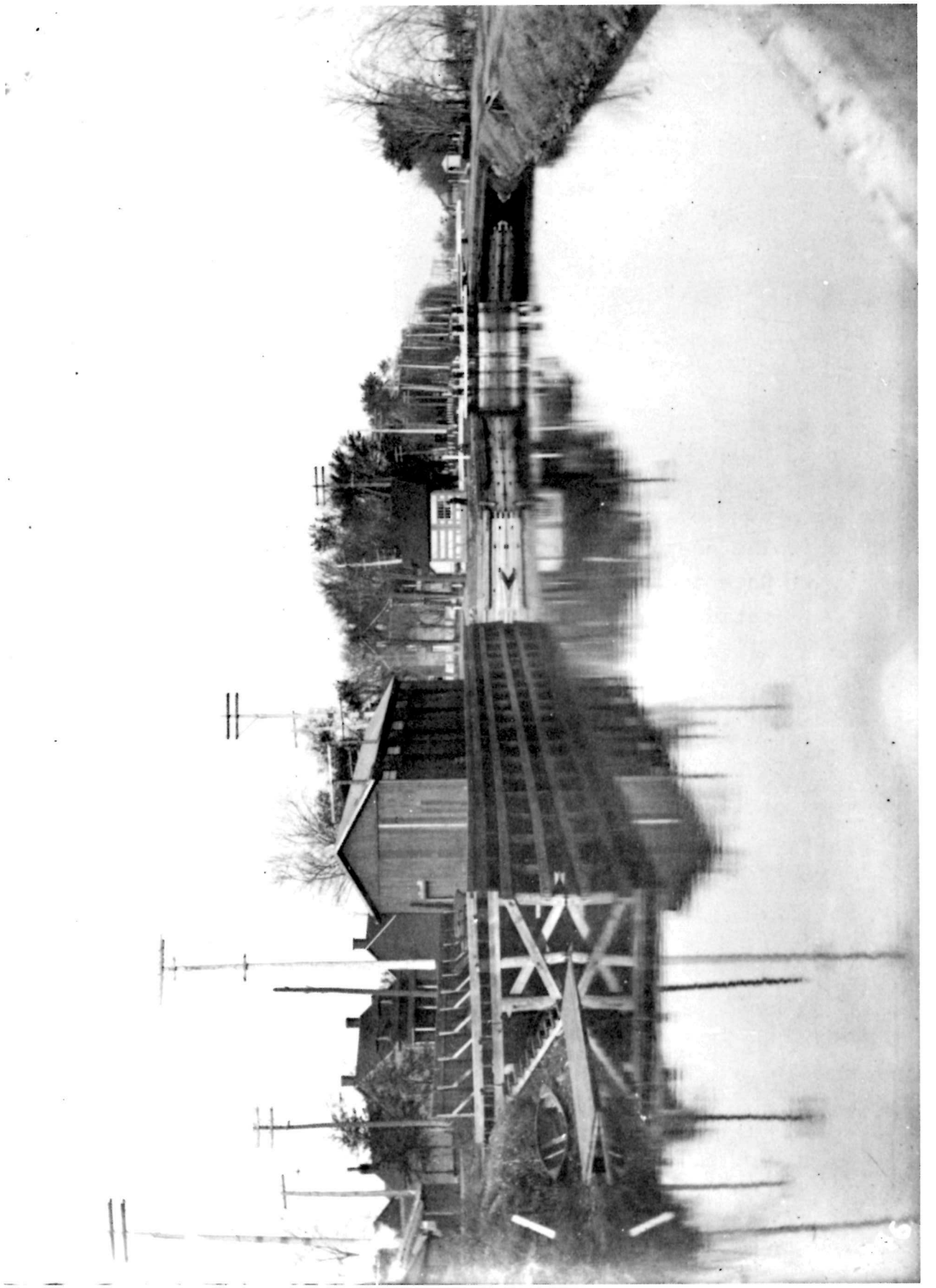
Today only the main east wall of lock 9 retains its 19th-century appearance of timber and masonry as it was rebuilt in the 1880s. The east entrance walls, as well as the entire west side and the bottom of the lock, are all concrete. Moreover, the remaining historic aspects of the lock, the east wall and the site of the lock itself, are now threatened with destruction and replacement by a new lock further downstream.

33 "Bird's eye view of St. John's, P.Q., Domin. of Canada," by H. Wellge. Note the guard lock and the southern entrance to the canal. (Public Archives of Canada.)

1. Court House and Jail
2. Asylum
3. Merchants Bank of Canada
4. Banque de Jean
5. Eglise de St. Jean
6. English Church
7. Methodist Church
8. Hopital des Soeurs de la Charite
9. Convent de la Congregation
10. College
11. St. Johns Stone China Ware Co.
12. Canada Pottery
13. Queens Ware Pottery
14. St. Johns Porcelain Work
15. St. Johns Boot and Shoe Factory
16. Fire Station
17. St. Johns Hote P. Monnette, Propr.
18. St. Charles Hotel, A. Bonneau, Propr.
19. Round House, G. T. R. R.
20. Freight Sheds, G. T. R. R.
21. Lock of Canal

BIRDS EYE VIEW
OF
ST. JOHNS, P.Q.
DOMINION OF CANADA.
1881.

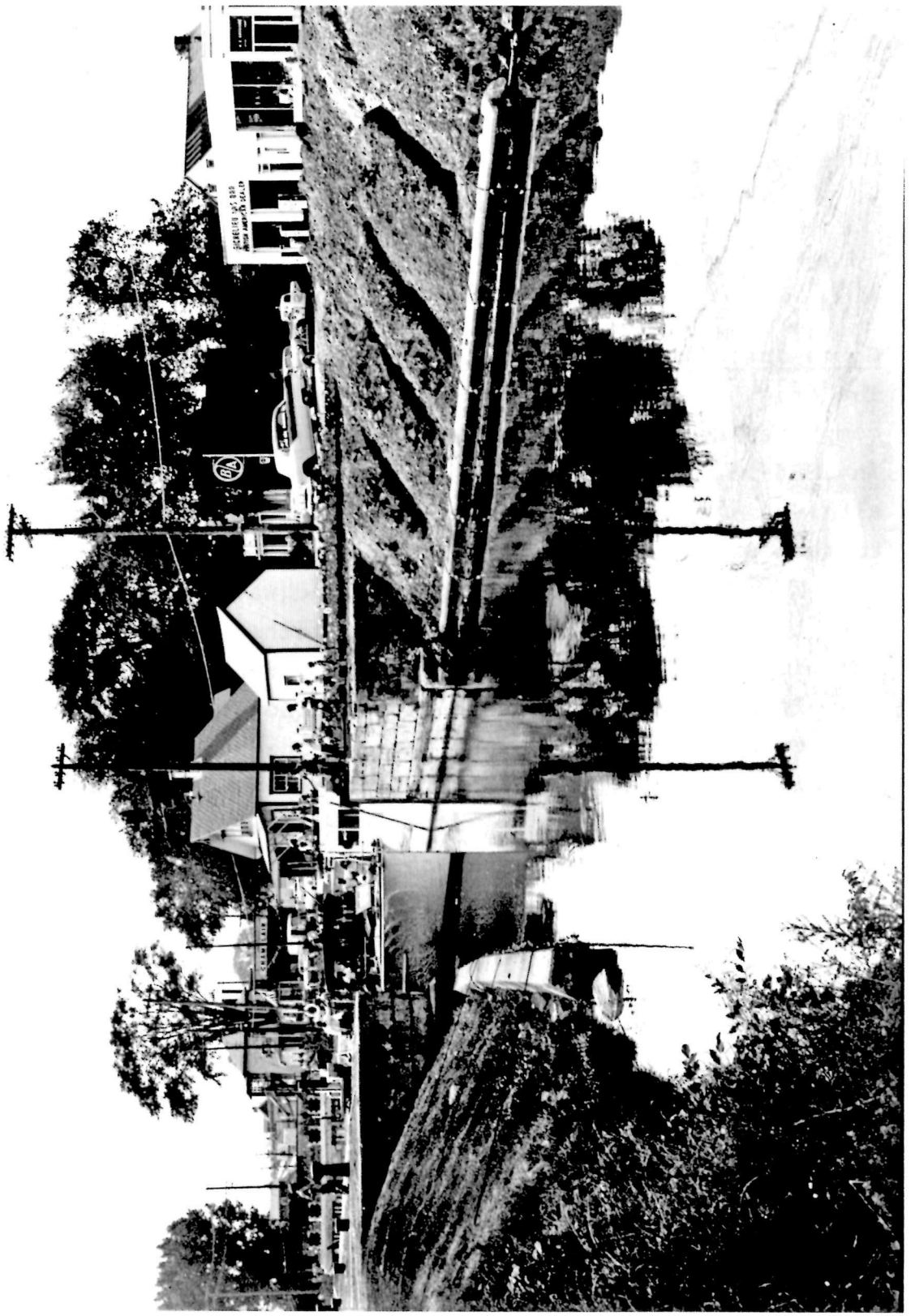
34 The upper entrance to lock 9, 1907. Note the timber wing and entrance walls. (Public Archives of Canada.)



35 The guard lock, looking north, ca. 1904. Note the timber and masonry chamber wall dating from the 1880s. Note also the two sluices on each of the upper gates. (Public Archives of Canada.)


232

36 The lower entrance to lock 9 in 1954, looking southwest. Note the recent earth fill behind the concrete entrance walls. (Public Archives of Canada.)



Gates and Gate Mechanisms

Gates Installed on the Locks in 1834 and 1835

The original lock gates installed for locks 4 through 9 when completed were designed by William R. Hopkins and installed in 1834-35. No plans for Hopkins' gates have survived, although the 1831 specifications and the 1834 modifications to them are extant. According to the 1831 specifications,

> The Gates are to be of good sound white oak timber free from sap, shakes or other imperfections, and well seasoned, the upper and lower gate bars to have double tenons each and every tenon to be eight inches long and equal in width to the depth of the timber.
>
> The Irons for securing the gates to be of the dimensions required by the Engineer they are to be let into the timber and be secured with screw bolts, an iron band half an inch thick by two inches wide to be fitted to the lower end of the quoin post, and in the bottom of the post a cast iron pedestal and pivot on which the gate is to turn shall be placed under the centre of the quoin post on the flooring of the Lock as the Engineer may direct.
>
> Two cast iron paddle gates or valves shall be placed in every gate, requiring eight for Each Lock.
>
> The valves shall be of the Shape and Size

> as the Engineer may direct and fitted according to his directions to the Lock gates.
>
> The valve rods are to be of round iron two inches in diameter and of sufficient length to reach one foot above the ballance [sic] beam, wrenches or levers will be required to be secured to every gate rod.
>
> Drawings and bills of iron will be furnished for the upper hinges of the Gate as well as for the iron above mentioned; it must be of Russia or Swedes or good Canadian iron or of a quality equal to either.[1]

The 1834 contract made provision for a measure to give added strength to the gate:

> Two rods are to be placed in the woodwork of the gates one from the lowr corner of the toe post to the head of the heel post the other across the top of the gate as the Engineer shall direct.[2]

Precisely how closely the Andreses adhered to the specifications is difficult to state with certainty. The statement of extra work submitted by the contractors in October 1835 (see App. D) and the description of the gates by George Keefer in 1839 provide some details of exactly what the gates looked like when installed on the gates and do indicate that there were some modifications made by the Andreses. Unfortunately the lack of full documentation prevents us from knowing the extent of these changes.

The implication to be drawn from the Andres' 1835 claim is that the gates were built as specified, with the addition of several features for which compensation was being claimed. Stone weights had to be put on the lock gates by means of nuts and bolts (and presumably straps) to provide sufficient balance.[3] J.B. Jervis had recommended in 1833

that the paddle gates be 25 inches square instead of an unmanageable 30 inches square as proposed.[4] Whether his advice concerning dimensions was accepted is not known. What is known is that the finished iron paddle gates each weighed about 100 pounds. The sluice rods were 1-3/4 inch iron. There were stops on these rods to keep the paddle gates open. The contractors also submitted a claim for "paddle gate springs."[5] Precisely what purpose these springs served and precisely how the sluice (or paddle gates) were regulated requires further investigation.

George Keefer, when asked in 1839 to report upon the repairs required on the canal, wrote that the paddle gates were in such a "bad state" that it was "almost impossible to pass through the Locks." He reported that most of the paddle gates had been broken and that they had been mended by wrought iron bars riveted on them. At the same time the friction of the paddle gates and the moving water was wearing away the wood on the lock gates and causing them to leak badly. Keefer recommended that these paddle gates be discarded and replaced by a plate of double boiler iron moving up and down in a cast iron frame placed on the upper planked side of the gate. He further suggested that the paddle gate be lifted and lowered by means of a "common lever" attached to the balance beam.[6] The plan that Keefer enclosed with his report has unfortunatly been lost.

No work seems to have been done immediately to correct the problem of the paddle gates. N.H. Baird reported in 1840 that he had replaced the iron paddle gates on the guard lock gates only with temporary wooden lifting sluices.[7]

In the following year Keefer, now the engineer in charge of the works, wrote that he had commenced the temporary repair of the old lock gates, which included installation of new paddle gates which opened and shut with a "common lever" connected to the balance beam. (Precisely

what Keefer meant by a common lever is unclear though he may have been referring to a system similar in principle to a car jack.) In fact Keefer's later comments imply that new paddle gates were not installed and that the old ones were merely improved. Also lending substance to this latter claim is Keefer's assurance that all had been done in the "cheapest manner" and would last until the old lock gates were replaced with new.[8]

In May Keefer reported that the job was done, although he warned his superiors that the paddle gates would not work properly until they were operated by rack and pinion, since the power of the lever was insufficient under a full head of water. In the same letter he wrote that he feared that the gates of the upper lock (possibly the guard lock) would not last the summer. He said that one of the transverse bars had already given way and had been secured by bolting a bar of iron on the back of it and fastening another timber on top.[9]

In the fall of 1841 Keefer again hammered away at the need for new paddle gates operated by rack and pinion. He assured the economy-minded commissioners that the new apparatus could be transferred to new gates when built.[10] Later that year he informed the Board of Works that many of the old toe and heel posts had decayed and that many of the bars of the upper lock gates had given way. So defective were the lower gates on the guard lock that six to eight men were required to open them.[11] That year he reported that two snubbing posts had been placed at each lock to reduce damage to the gates.

During the 1840s attempts were made to repair the old gates, particularly those on the guard lock, to improve their operation. During 1843 D. and T.L. Wilkinson, contractors for the gates for the combined locks then under construction, repaired weak points and breaks in the gates

With oak boards nailed with spikes to the timbers. On the guard lock the Wilkinsons installed new wrought iron collars and anchors, as well as rack and pinion lifting devices made of wrought and cast iron for the raising of the paddle gates, a measure which Keefer had been proposing for four years. Some of the castings used on the lock gates were brass.[12] A register now in the Public Archives of Canada indicates copious correspondence in 1845 dealing with the proposed replacement of the old sluice gates.[13] Unfortunately the letters themselves have been lost and the outcome of the question is unknown. It is, however, doubtful that the iron iron paddle gates were replaced at this time.

Despite these repair efforts, Mr. A. Barrett reported in 1846 that the gates on locks 4, 5, 6 and 7 (old 6, 5, 4 and 3 respectively) were in deplorable condition. Barrett attributed this to poor design and fabrication, and noted that

> The "Balance Beams" are of white pine, and some of them are much decayed. The Ironing of the Bars of the Gates is very badly done, the T & L Plates not being one fourth the size or strength necessary, while the manner of putting them on is as objectionable as the Iron itself. Many of these were omitted or left off the Bars altogether in their construction, so that the Gate wrings and twists so much in opening as to render that duty laborious - continually wreaking the joints or connections with the hollow quoin and toe post and causing the plank to become loose and leaky. The planking of some of the Gates is much decayed. The valves require to be reset, being out of adjustment, and wasting much water.[14]

Barrett, rather than recommending new gates at an

estimated cost of $800 each, suggested further repairs, such as new balance beams, replanking and some new T and L plates, which would allow the old gates to last a few more years.

The repairs were made to the gates of locks 4, 5, 6 and 7 in 1847 and 1848. The records of the materials required for this repair work add many details to our knowledge of the design of the gates, although the gates of course varied from lock to lock depending upon the width and lift of the latter. The planking on the upstream side of the gates was of 2-inch boards. Required for the new heel posts on a pair of lock gates for locks 5 and 6 were oak timbers 19 feet by 16 by 13 inches; for the toe posts the timbers were to be 18 feet by 14 by 13 inches. Six oak timbers, 14-1/2 feet by 14 by 13 inches, and 10 oak timbers, 14-1/2 feet by 12 by 10 inches, were required for the transverses.[15] The heel posts on locks 7 and 4 were recorded in 1848 as 11- by 15-inch timbers and the tranverses 8 by 10, although their lengths are not reported. It was recommended in the latter case that the heel posts be increased to 13 by 15 inches and the bars to 12 by 8 inches, "which is the least size compatible with stability and was also the size originally intended."[16] The size of the T plates in the canal stores in 1852 was about 18 inches by 3 inches and the L plates were 12 by 2 to 3 inches. The valves were described as made of "cast sucker."[17]

The balance beams requisitioned in 1847 were made of pine timber, 36 feet long and 12 by 26 inches at the larger end. They were attached to the gate with long bolts and nuts. The footbridge, and apparently the handrails as well, were made of 3-inch plank.[18]

Despite the repairs made to the old lock gates, they continued to be unsatisfactory, in part because the paddle gates were too small. Sometime before 1852 the sluices on

the lock gates seem to have been enlarged to allow speedier filling and emptying of the lock chambers. Even then some of the paddle gates were so hard to work that canal officials in 1852 had to borrow spare lifting gear from the Lachine Canal stores to augment them.

New gates of unknown design were built for the guard lock at St. Jean in 1847 and 1848. Then in 1850 spare gates were built for that lock and stored, either under cover or submerged in the canal, until required.[19]

Gates Installed on the Locks Completed in 1842

On 27 September 1841 David and J.L. Wilkinson, builders residing in St. Anne's, Quebec, signed a contract with the commissioners of the canal for the construction and installation of "six pairs of good and substantial Lock Gates." The contractors agreed to build paddle gates to be opened and shut by rack and pinion, but it is not clear whether these were for the wall sluices or the lock gates. They agreed to make the gates exactly to the specifications signed by George Keefer 1 May 1841.

> The framing to be of the best quality, white oak timber, well planed, the cross bars to be framed with single tenons of such length and dimensions as shewn in the plan. Two treenails of one inch oak to pass through each. The rails to be sunk 1-1/4 inch into the mitre and heel post its full width and thickness and well secured with wrought iron Ts and Ls as hereinafter described. The heel post shall be framed into the top rail with a single tenon 5 inches long, the lower end of the heel post to be banded with a wrought iron band of 5/8 inch iron 3 inches wide put on hot and well wedged - a tension bar

put on diagonally is to be put through the Bars as shewn in the plan and screwed by a nut and screw at each end. The Gates to be planked vertically with good 2-1/2 inch red pine plank well jointed, tongued and grooved. The tongues to be 5/16 inch wrought iron, 2 inches wide. The plank to be let into the rebate flush with the mitre sill and heel post, and fastened down with 5 inch rose headed spikes, 2 in each end and one in each rail. The head of each spike to be wrapped in oakum and saturated in boiling tar.

All the planks are to run their whole length from top to bottom. A balance beam of such dimensions as shall be considered necessary to be fastened down upon the top rail with iron plates 5 x 4 inches and 5/8 inch thick and bolted with 3/4 inch bolts.

A 20 inch gang-way to be suspended from the top rail by 4 iron knees 1-1/4 inches square passing through the top rail and mitre post at equal distances and screwed by a nut and screw at down side of gate to be turned at right angles and taper to one inch at the height of 2 feet 6 inches above the gang-way to form stanchions for hand rail of one inch round iron as shewn in the plan. The Ts and Ls to be of the size and dimensions shewn in the plan to be fully bedded in the Timber and secured with seven 3/4 inch screw bolts. The collars to be of wrought iron 1 inch thick by 4 inches broad, and fastened to cast-iron anchor straps as shewn in the plan.

The pivots and sockets for heel posts to be of the best quality of cast iron.

> The joints and tenons to be coated with white lead when put together and the whole to be coated with 2 good coats of archangel tar or any other composition the Engineer may think advisable.
>
> The whole to be done in the best manner and to the entire satisfaction of the Engineer or the person superintending the same.
>
> The timber to be delivered immediately and sunk in such place as the Engineer may direct until such time as the Contractor shall be required to raise it, the timber to be free from warp, shakes, saps or any defect whatsoever.
>
> The Gates to be completed and hung by 1st May 1842. All wrought iron used in the gates to be either Swede's or Bank's best.[20]

Unfortunately the plans to which the specifications refer have not been located.

Further insight may perhaps be gained from Keefer's calculations of the component parts of the wooden gate drawn up in 1839, though it must be kept in mind that he may well have changed his mind in the two intervening years. According to Keefer's calculations a gate was to consist of 8 transverse bars, each 14 feet long and 13 inches wide. They were, however, to vary in thickness, with 3 bars 10 inches thick, 3 others 8 inches thick and one only 3 inches thick. The toe post was to be a timber 18 feet long by 12 by 14 inches, while the heel post required a timber 19 feet long by 14 by 16 inches.[21]

Also listed in Keefer's calculations was the iron work - the collars, "wedges", "keys" and anchors. The T and L plates, as well as the bolts, nuts and washers, were also to be of iron as were the bands on the heel posts and the straps over the balance seams to keep them in place. Also

included were rods of round iron. The rods which Keefer envisaged, and which one can still see on both lower gates of lock 1 today, were long round bars affixed at one end to the anchors at the quoins and at the other end to large stone sleepers about 20 feet in the rear of either wall of the lock to give extra strength to the gate. The hand rail on the gate was also to be iron. The gates were caulked with oakum.[22]

Evidence indicates that, with the exception of the lower gates on locks 1 and 8 (old locks 9 and 2 respectively), the gates on the combined locks and lock 8 were built without sluices. Water went into all these locks and out of locks 2 and 3 through sluices or culverts in the chamber walls around the masonry breast walls. No wall sluices, however, were built around the lower gates of locks 1 and 8 and thus sluices were necessarily placed in the gates. The lifting machinery for these paddle gates on the lock gates seems to have been of the rack and pinion type. At least some of the castings on the gates were brass, although the lock gates themselves were held in place in the quoin by a wrought iron collar, as had been specified.[23]

Like the gates on the older locks, those on the combined locks proved less than satisfactory. The problems were mostly due to an insufficient flow of water into the chambers and to the smallness of the sluice gates which created delay in the passage of traffic. There is a suggestion in a letter written by J.F. McDonald in 1851 that valves had been made in the gates of the combined locks in an effort to remedy the problem. He reported too that the sluices on the gates were being increased from an area of 4 feet 8 inches (2 feet 4 inches by 2 feet) to 7 square feet by increasing their height 14 inches.[24]

New Gates, 1850

By 1850 the construction of new gates of an improved design for the locks built in the 1830s could be put off no longer. The old gates still in use were now much repaired and decayed and all the spares had been put into use. Unless new gates were built, damage to a gate could close down the canal completely for many days while a replacement was built. As a result contracts were awarded to John Donnelly in 1850 and to Benjamin Chaffey of Cornwall in 1852 for the construction of new gates.[25]

Detailed plans to scale for the several pairs of lock gates to be built by Chaffey have fortunately been preserved in the Quebec Canals Office in Montreal (see Figs. 37 and 38). Moreover these plans are said to correspond to the design for the gates which had been constructed by Donnelly two years earlier.[26]

According to the plans the gates were to be of wood, consisting of seven transverse timbers of gradually diminishing size from bottom to top. The heel and toe posts were to be similarly made of wood, all held together with T and L plates. The gates were to be framed on the upstream side with planks spiked to the transverses. (The timber frame was probably to be of oak and the planking of pine.) Further stability was to be given to the structure by means of a diagonal rod, probably of iron, stretching from the outer side of the upper heel post, through the post and transverse bars, to the underside of the gate where it was to be secured with a bolt. The balance beam, a long continuous piece of hand-hewn timber tapered at the inner end, was to be fixed to the heel and toe posts with long iron bands bolted to the wood. Below the heel post there was to be an iron pivot on which the gate moved.[27]

The sluice in each new lock gate was to be situated

between the two lower transverses which were given extra support by iron rods beside the opening. The paddle gate, made of wood and bordered with metal (probably iron) was to move up and down in a wooden frame on the lock gate. The paddle gate rod, also of metal, again probably iron, was to be lowered and raised by a cast iron rack and pinion worked with a crank. A stop was to be attached to keep the rod stationary. The rack and pinion lifting device was to be attached with bolts to vertical planks affixed to the upper transverse timber and to the balance beam.

A wooden walkway, placed just above the level of the coping and supported by brackets bolted to the balance beam, was to allow access across the gate. No railings are indicated on the plans but it is doubtful if the gates would have been installed without them.

Gates based on the 1852 plan, though of course varying in width and height to fit the exact dimensions of each lock, gradually seem to have replaced all the old gates in the Chambly system as the need arose. They too were periodically replaced, in bursts of construction activity in the canal workshops, when canal officials were successful in convincing Ottawa that the canal might be closed down by failure of the gates unless money was forthcoming for replacements and spares. These replacements seem to have been built for the next half-century according to the plans given to Chaffey in 1852 (see Figs. 39 and 40).

The new gates for the combined locks, except at the lower end of lock 1, seem to have been built once again without sluices, with full reliance for the water supply on the wall sluices. Yet once again this system proved inadequate and in 1867 the department reported that "a third sluice [apparently in addition to the two in the walls] had been installed in each pair of gates to facilitate the lockage."[28] That year it was also reported that the upper

gates on the guard lock at St. Jean had each been equipped with a second sluice.

Although a logical precaution against a sudden breakdown of the system for several days would have been to have spare gates in storage to fit each of the locks, the low budget for canal operations in this period prevented it. As a result, delays in the traffic while gates, damaged by boats, were repaired or replaced were not uncommon. Certainly a major problem (as pointed out in the annual report of the Department of Railways and Canals in 1887) was that "owing to the different sizes of the locks on the canal it is necessary to have on hand at least eight different sizes of spare gates in case of accident." The minister added that a pair of gates lasted, with repairs, about 10 years.[29] (To the lower gates at lock 9 in 1892, for example, were added 4 oak bars, 10 inches by 10 inches thick, to give additional strength to the gates.[30])

Improvements to the Gates, 1892-1901

Until the last decade of the 19th century the lock gates were opened by the canal staff entirely without mechanical aid. Then, in the spring of 1892, manually operated crabs (or windlasses) equipped with cranks were placed at one of the lower gates on each of locks 1, 4, 5, 6, 7, 8 and 9. These windlasses shortened and lengthened chains attached to the mitre posts just below the walkway to facilitate the operation of the gates (see Fig. 40). At the same time the superintendent of the canal reported that several patterns for castings had been improved, as had been the mechanism to open the sluices.[31] Unfortunately he did not elaborate.

Further efforts were made in following years to improve the efficiency of the gates which, despite the increasing

traffic on the canal, persuaded the authorities that they could reduce the staff from four to three men per lock, except at St. Jean. (Each man was on duty for 16 hours per day in two shifts!) The superintendent described some of the improvements in his annual report in 1896:

> Les coulisses contenant à l'intérieur des nombres de fontes d'un pouce et demi de diamétre sur lesquels glissaient les vannes dans les portes d'écluses necessitant après quelque peu d'usage, la force reunie de deux hommes pour les lever ont été remplacées par des coulisses de fonte, nouveau modèle avec roulettes mobiles faisant saillie en dehors de la coulisses sur lesquelles la vanne roule en montant et en descendant.[32]

Other work involved the installation of gangways with iron edges and stop posts driven into the ground for the balance beams. Oak bars were placed across some of the gates to strengthen them.[33] (For other repairs see App. K.)

Other improvements some time later involved the "anchor blocks" on the coping, which, according to the department in 1900, had proved "cumbersome" and "objectionable". They were replaced that and the following year by "iron straps notched into and strongly bolted to the top walls." In consequence the tops of the gates had to be remodelled, though precisely how is not recorded.[34]

The Gates as Seen in Photographs, 1894-1911

It is fortunate that there are available many photographs of the lock gates in use on the canal for the period 1894-1911. The 1894 and 1904 photographs indicate that the lock gates were basically of the same design as those installed in the

mid-19th century. There were, however, some variations and additions from the 1852 design. Some features, such as the balance beams, were not shown in their entirety in the plans and therefore it is difficult to say whether they had changed at all since mid-century. All the gates were equipped with forged iron rod railings affixed to the balance beams. The balance beams were hand-hewn, not sawn, and were curved at the outer end; how this curvature was accomplished - by cutting tools, by steam, or by some other process - is unfortunately not recorded. It can be seen that some of the balance beams consisted of two pieces of timber bolted together, perhaps the result of a quick repair job after a breakage. At the outer end of each balance beam was an iron rod which could be fixed to a hook of some sort in the ground in order to keep the gates open. When closed it was held by the wooden post mentioned above. All the locks seem to have been equipped with windlasses, though whether they were installed at each gate is not clear from the photographs. At each lock there were wooden (oak) snubbing posts to which boats locking through affixed their lines (see Figs. 39, 40 and 41).

Other variations had been made on the gates on the combined locks to give them further strength, probably in the mid-1890s. On some of these gates, for example, there was an additional crossbar at the top of the gate just below the balance beam (see Fig. 4); the diagonal bars on some gates too were thick plank rather than the iron rod used on others (see Figs. 4 and 14). (On some there was a flat iron bar bolted on the rear face of the lock rather than fitted through the transverses - see Fig. 41.) Also seen are the planked catwalks placed across the inconveniently located masonry stairs to allow the men to open the gates. The photographs of the combined locks also show the sluice gates, operated by rack and pinion, which had been installed

on each of the lock gates (see Fig. 41) with the exception of the lower gate at lock 1 where there were two sluices on each gate. The purpose of these gates was to take pressure off the wall sluices - and thus the walls - and to hasten the filling of the locks. As John G. Sippell had pointed out in 1873,

> wherever the sluices for passing water into the Locks, are placed in the side walls, the effect has been to destroy and weaken the walls....The walls of the locks on the Ottawa canals became so much affected by these water passages, that it became necessary to fill them up and pass the water through sluices placed in the gates.[35]

Nevertheless both sluice systems continued to be used on the Chambly Canal.

New Gates, ca. 1904-11

A 1911 photograph of the lower gate on lock 7 indicates that a modified type of wooden gate was being introduced on the system by 1904 (see Fig. 42). Certainly by 1911 these new gates seem to have been common on the canal and were the standard replacement when the old gates were damaged or simply gave out from old age. From the pictures they appear to be very similar to those in use on the canal today, although without the actual working plans it is difficult to make this contention with any great certainty.

Despite the lack of plans, certain basic features of the new-style gates are evident. The gate, built with a frame of vertical timbers, had transverse bars only near the top below the balance beam and at the bottom. The timbers were planked horizontally with British Columbia fir, usually on both the upstream and downstream side. All were held

together with bolts and spikes. Flat iron bars, both at the mitre posts and diagonally across the gate from the upper to the lower bars, gave additional strength to the structure. Other features - the balance beams and iron work, the walkways, the sluice gates and the rack and pinion machinery - seem not to have changed. The racks and pinions in particular were probably reused on new gates and not replaced unless absolutely necessary; indeed some of those still in use on the canal may well have been there for over a century (see Fig. 23).

The 1911 photographs also indicate other recent additions to the gate machinery. Additional windlasses, their frames distinguishable from the earlier bell-shaped frames, had been installed on some of the gates which had been left unassisted in 1904; some, however, were still moved without mechanical aid. On some of the locks rollers affixed to the coping guided the chain between the gate and windlass. (The departmental report for 1908 had reported that the lower gates had been equipped with Manny's lock gate protection bar;[36] what they were and consequently whether one can see them in the photographs is a mystery!)

Replacement of the Balance Beams with Machinery

By World War I the canal authorities were finding it increasingly difficult and expensive to procure white pine of sufficient size to replace the balance beams as the old ones wore out. Indeed they had gradually been forced to reduce the size of the beam - by 1911 to 16 inches at the butt tapering to 13 inches at the small end with a bend of 6 to 12 inches at not less than 16 feet from the small end and a length of about 30 feet.[37] Within two years the specified size was reduced to 14 inches, a size which Ernest Marceau,

engineer for the Quebec canals, said he could not procure.[38] To remedy the problem Marceau proposed that simple machinery, plans for which he had already drawn up - and which are now in the Quebec Canals Office - be substituted for the beams. He asked for authority to purchase 20 such machines and to get ahead with the work.[39]

The auditor-general's report for 1913 indicates that 20 machines enclosed by a column and cover - enough to open 20 gates, or all the gates on 5 locks - were installed that year. The component materials of each machine were to be:

Steel plates and I beams - 376 lbs.
Shafting cold rolled - 69 lbs
Bronze bushings - 7 lbs.
Cast Iron - 760 lbs.
Babbitt - 5 lbs
Worm and Worm gear
Nuts, washers and bolts
Finishing (machine work)
Steel rollers - 3

Twelve cubic yards of excavation and 6 cubic yards of cement were to be required for the installation of each machine.[40] On what gates the machines made by J. and R. Weir of Montreal were installed is not recorded. Apparently locks 7, 8 and 9 were not included, for it was reported in 1921 that new machinery had replaced the balance beams on those locks that year. It is probably safe to assume that all the balance beams had been removed from the Chambly system by that year.

The new gate opening device was a simple one - a crank-operated winch with worm gearing which moved iron struts fixed to the gate at the level of the coping. These struts moved back and forth in a recess made by removing a section of coping and laying a cement bottom and sides (see Figs. 43 and 44). Planking was placed over the recess. It

is this system which operates most of the Chambly Canal gates today; the exceptions are on lock 9 and the upper gates of lock 3 where hydraulic systems have recently been installed.

The Lock Gates Today

The lock gates in use today - with the exception of the balance beams - appear to be substantially similar to the style introduced during the first decade of this century (see Fig. 45). Some modifications, however, are evident. Most obvious, of course, are the winches installed between 1913 and 1921 to open the gates and the very recent hydraulic system mentioned above. Some of the gates are now planked on both sides. Other changes include the replacement in the early 1930s of the wood heel posts by steel. On all the gates a second railing has been added for safety reasons. On some of the locks, lock 5 for example, the old style narrow iron bars have survived. On most, however, new railings consisting of thicker pipe, hollow in the centre, have been installed (see Fig. 12). On some of the gates steel walkways have replaced the old wooden walkways.

The Gate Covering

The earliest mention of the surface coating of the gates was in 1842 when George Keefer wrote that he intended to paint them.[41] He does not mention what colour would be used.

Paint may have proved unsatisfactory as waterproofing and protection for the gates. Several years later, in 1848, it was reported that the balance beams and gates were

"coal-tarred" annually. How long this practice of tarring the gates continued is not recorded. There was a requisition in 1861 for a barrel of coal tar and two coal tar brushes, but their intended use is not mentioned.[42]

Certainly tarring seems to have been discontinued by 1863 when a requisition included 6 kegs of white lead and 10 gallons of paint oil for the lock gates and bridges.[43] The painting of the gates apparently continued for many years. Photographs taken in 1894 indicate the use of a relatively dark-coloured paint, but it is difficult to determine from the picture or from the lists of materials used on the canal precisely what colour it would have been. (It is possible that tarring may have enjoyed a revival.) The balance beams appear to have been white.[44] Photographs taken in 1904 and 1911 show the gates and balance beams painted white (see Figs. 39 and 40). This seems to have been the case until recent years, though the colour may well have been a light gray. Unfortunately neither the black and white photographs nor the records seen to this day provide the answer.

In recent years the practice on the canal has been to paint the upper part of the gate grey and to coat the lower part below the waterline with an oily tar-like substance.

The Wall Sluices

Wall sluices, or culverts, were built around the upper gates and masonry breast walls of locks 1, 2, 3 and 8 when the locks were constructed to provide the necessary water supply for these locks. The problems encountered with the paddle gates on the locks built earlier seem to have persuaded Keefer that wall sluices would present fewer complications.

The water passing through these wall sluices, built in masonry, was controlled by sluice gates, one of which was

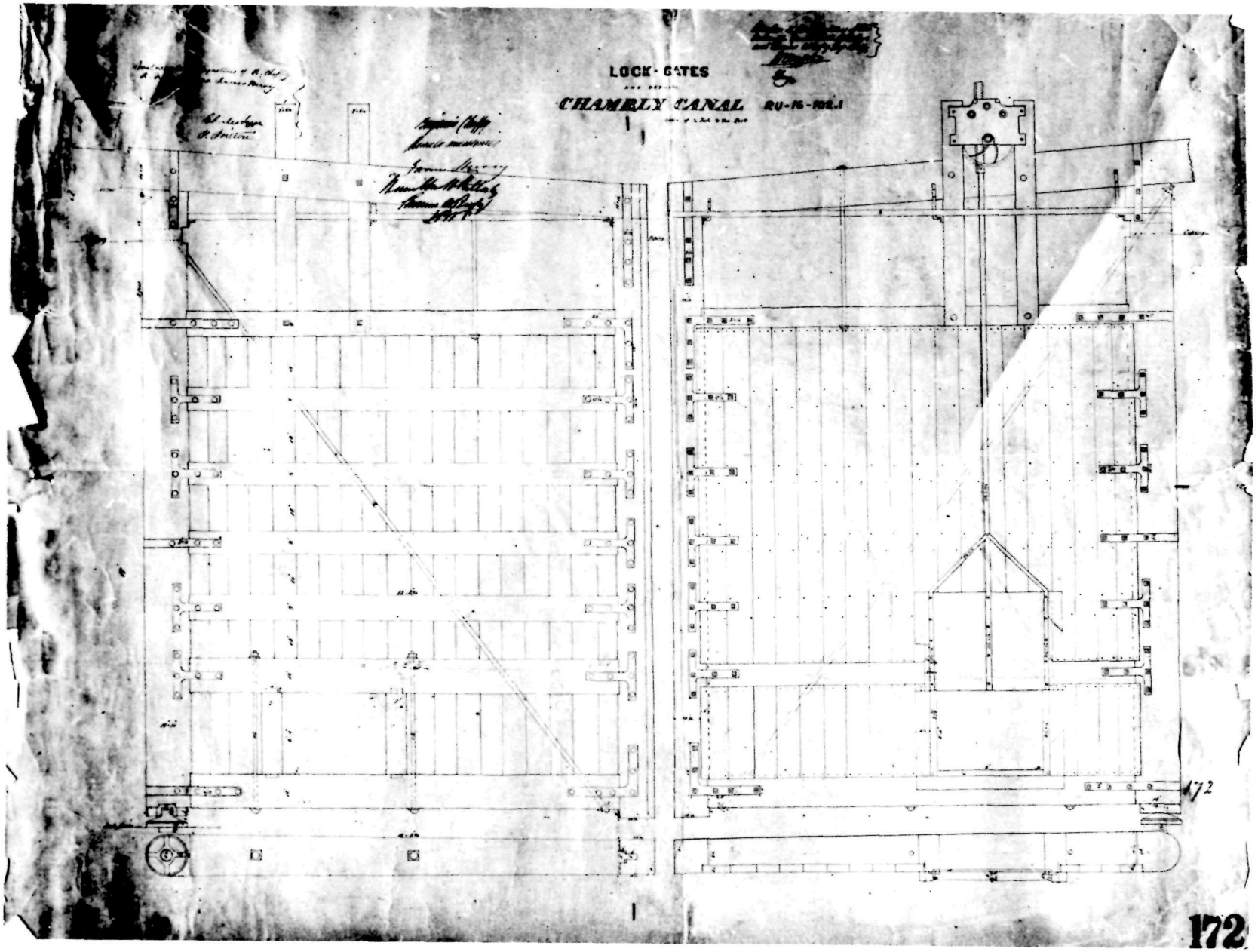
situated at the centre point of each culvert. Whether the gates were made of metal (as Keefer envisaged in 1839) or of wood is not known. Given Keefer's growing disgust with the metal paddle gates on the other lock gates, one suspects the former. Attached to the gates were long vertical rods which ran through a small shaft made in the embankment to ground level. The size of the rods, as calculated in 1839, was to be one-inch square by 18 feet long.[45] Whether the rods later installed were that size is not known. The gates were raised and lowered, according to a document on canal repairs in 1844, by ratchets made of cast iron, although the contract signed by the Wilkinsons in 1841 had bound them to "put on sluice gates which shall be made to open and shut with the Rack and Pinion according to a plan already furnished by the commissioners' Engineers."[46] It may be that the contractors were later told to substitute ratchets for the racks and pinions as an economy measure or that the term "ratchet" was used in error. (Or it could be that the sluice gates to which he referred were actually the paddle gates.) The document proposed their replacement by wrought iron ratchets; whether they were in fact is not recorded.

Little mention is made of the wall sluices in the annual reports or correspondence of the succeeding departments in charge of canals. There are occasional references to their repair and when the walls in which they were situated were reconstructed in the 1880s and early 1890s the sluices in the walls were, of course, rebuilt at the same time. It was reported, too, that between 1891 and 1893 improved frame sluice gates had been placed in the walls of locks 2, 3 and 8. The sluice frames were said to be 12 feet in height. It was also reported that the eight wall sluices had been renovated according to a new design, but unfortunately no details are given. It may have been new lifting devices to which the report was referring.[47]

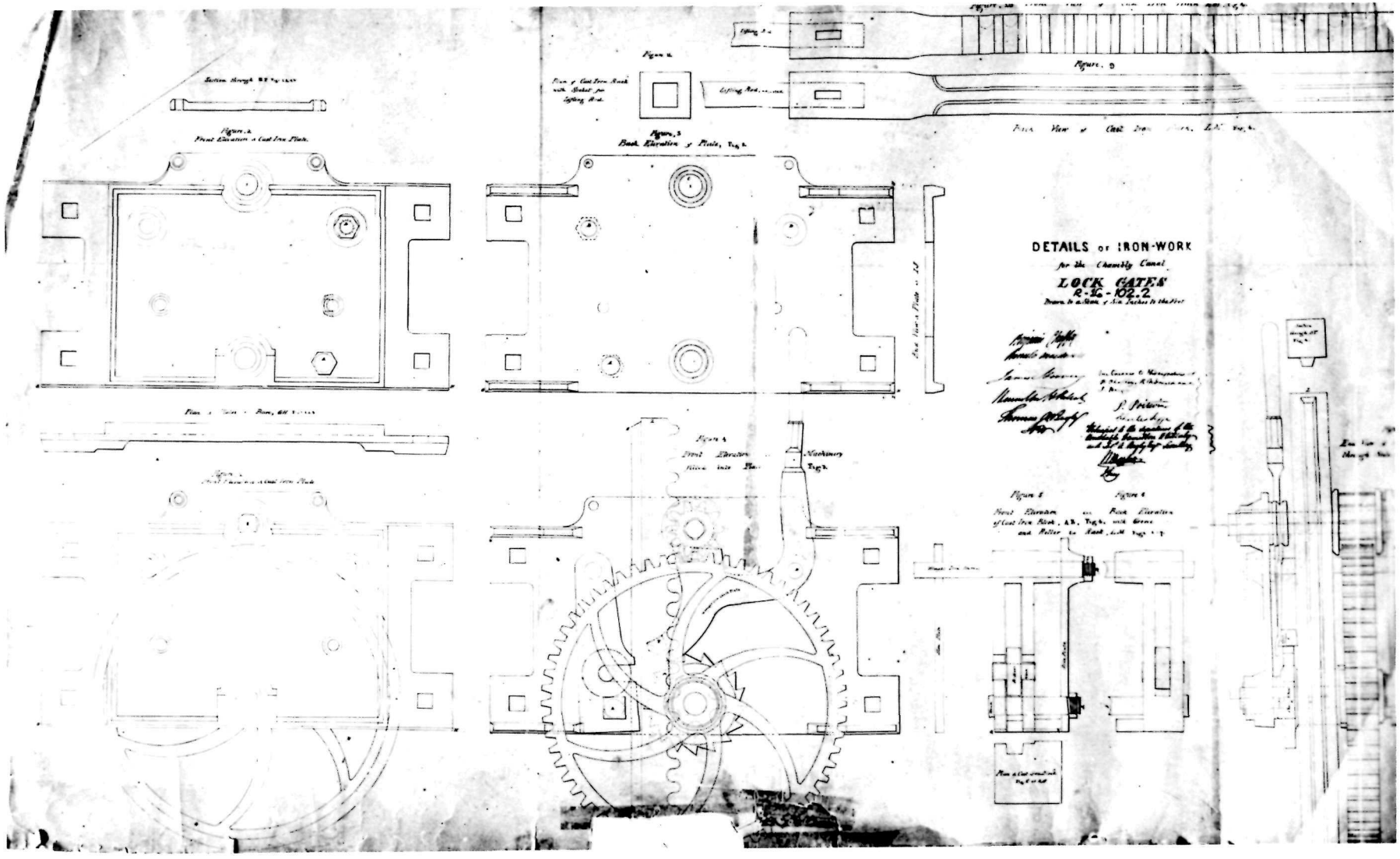
The earliest available photographs, taken in 1894, indicate that the lifting devices then in use for the wall sluice gates on the combined locks were racks and pinions operated with a crank (see Fig. 14). In appearance they are not distinguishable from the devices used on the gates. The exception is the lifting device controlling the sluice gate on the west side of the canal between locks 2 and 3. Unfortunately the details of this device cannot be determined from the picture. This machine probably predates the installation of the racks and pinions, but whether it is the device described in 1844 as a "ratchet" is impossible to determine from available information. Sometime before 1911 this peculiar device was replaced by a rack and pinion. The earliest available photograph of the upper end of lock 8 (Fig. 28) indicates that racks and pinions were used to lift the wall sluice gates. Precisely when they were installed is again unrecorded.

The racks and pinions remained in use until recent years, when they were replaced by electrically operated systems (see Fig. 8).

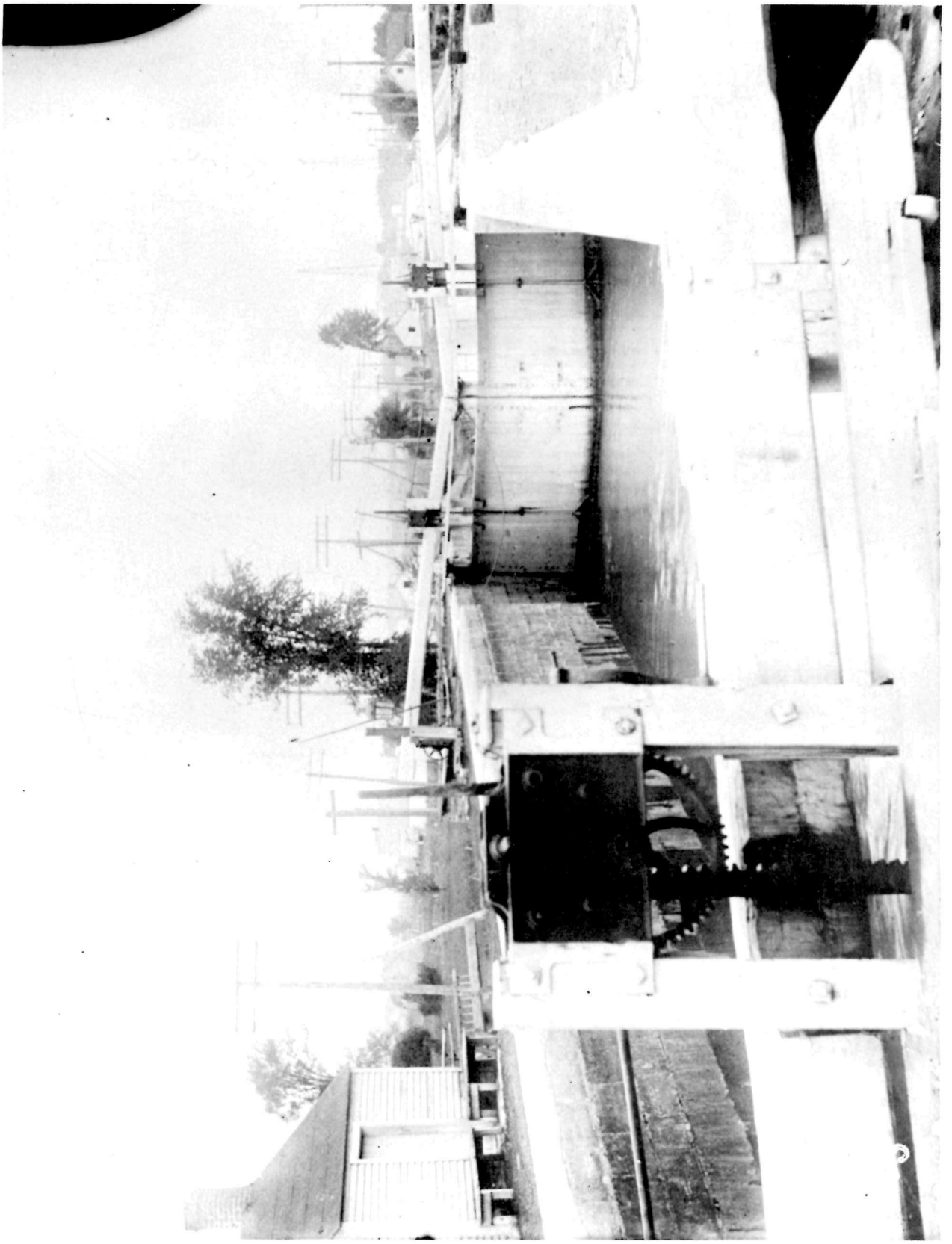
37 Plans for the lock gates constructed by Benjamin Chaffey, 1852. (Quebec Canal Office, Parks Canada, Montreal.)


LOCK - GATES
CHAMBLY CANAL
RU-15-102.1
172

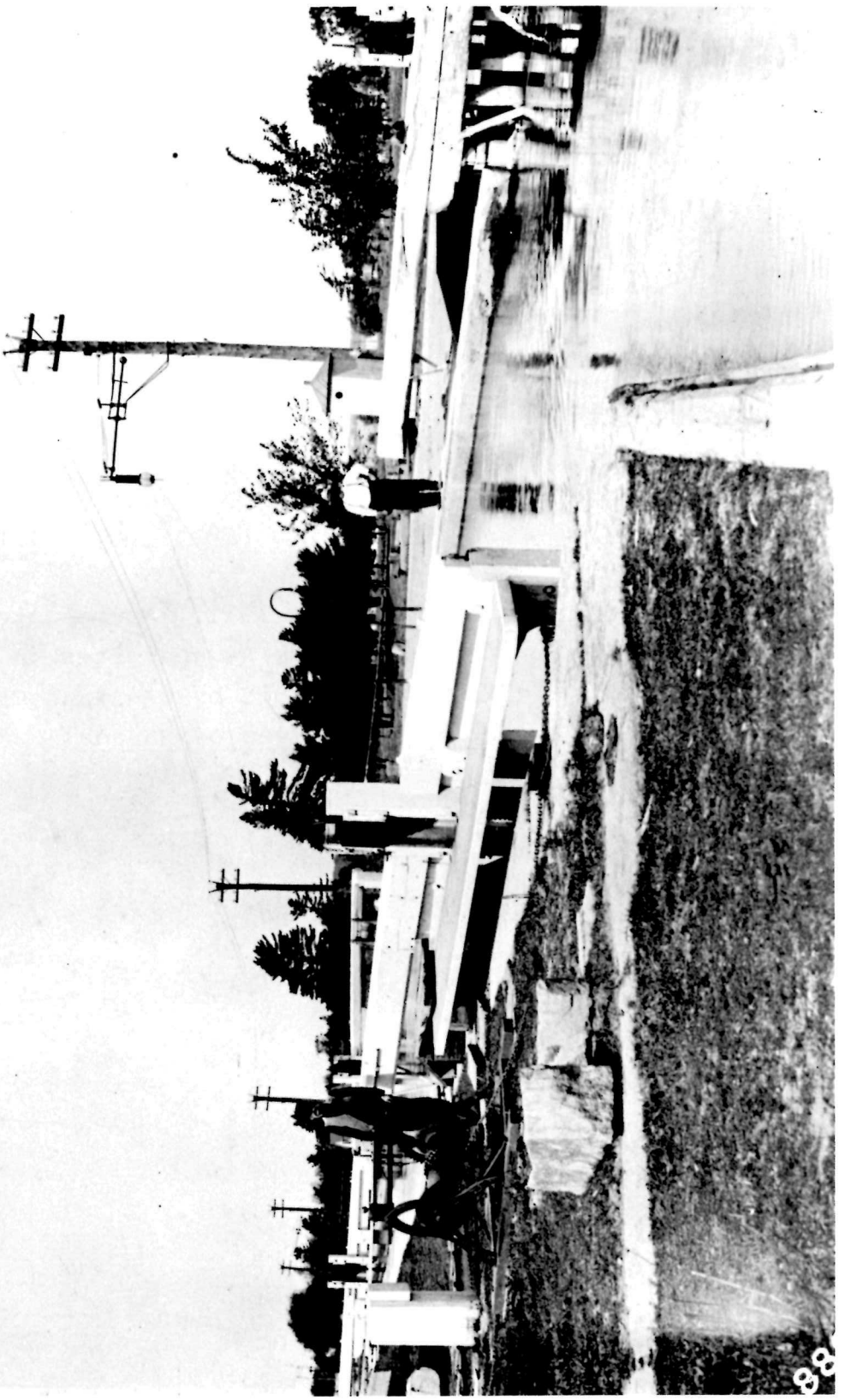
38 Plan for the ironwork for the lock gates, 1852. (Quebec Canal Office, Parks Canada, Montreal.)


DETAILS of IRON-WORK
for the Chambly Canal
LOCK GATES
R-No-102.2

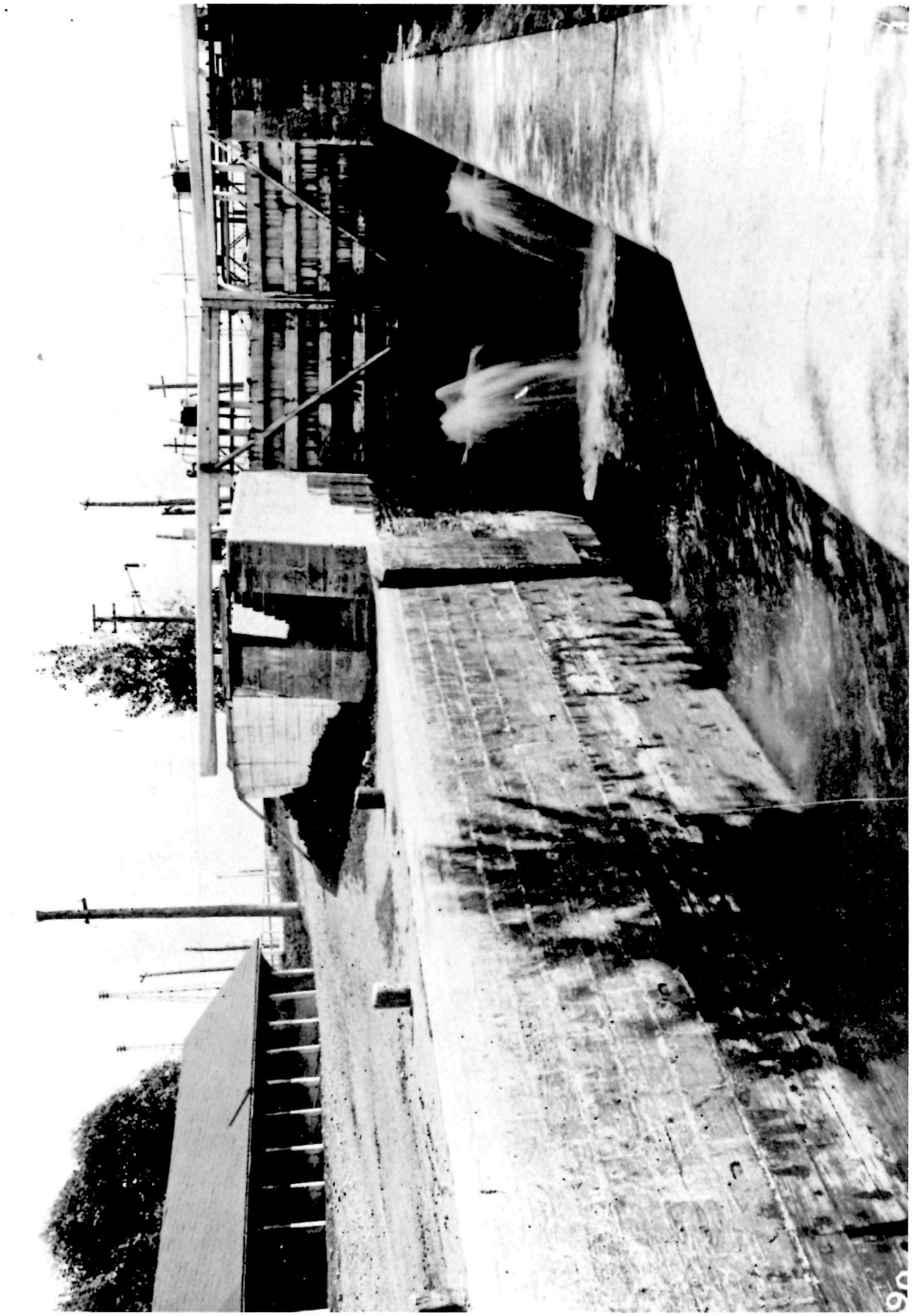
39 The upper gates of lock 5, 1904. Note the rack and pinion (left foreground) in use on the gates since about 1852. (Public Archives of Canada.)



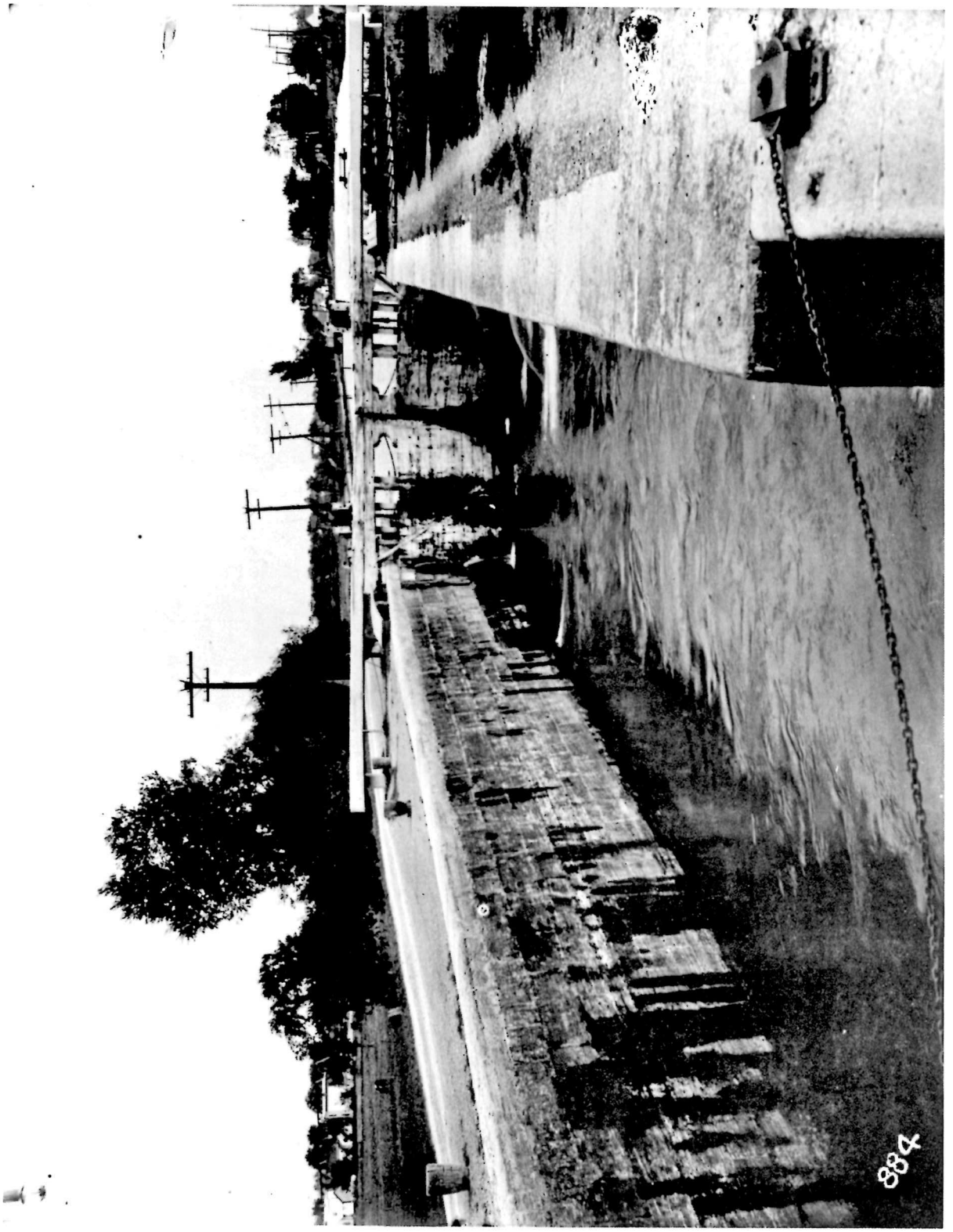
40 The upper gates of lock 5, 1911. Note the crabs or windlasses to open and close the gates and the rack and pinions to operate the sluice gates. (Public Archives of Canada.)



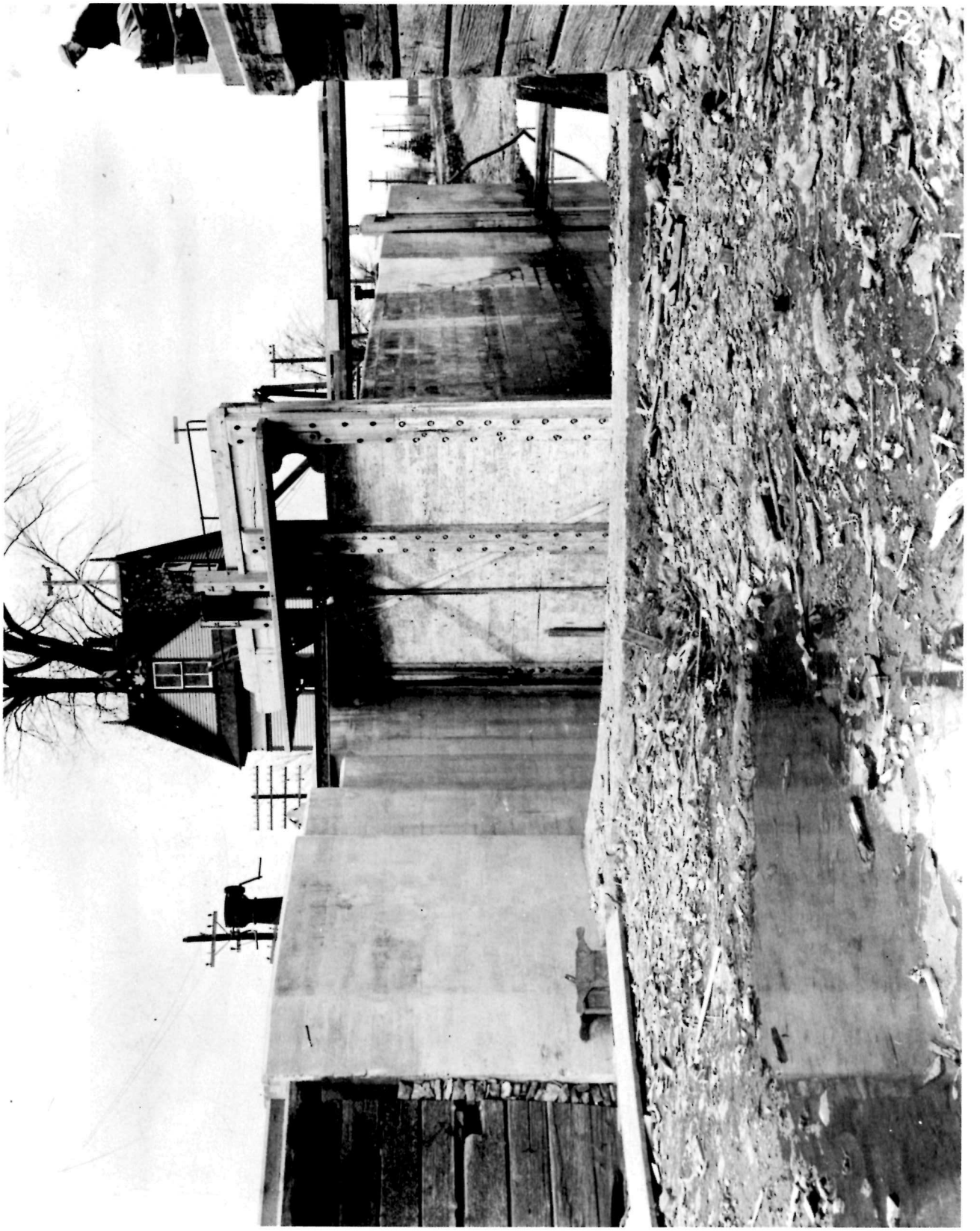
41 The gates at lock 2, 1911. These gates appear to be the same as the gates in the plans for the work done by Benjamin Chaffey, 1852. (Public Archives of Canada.)



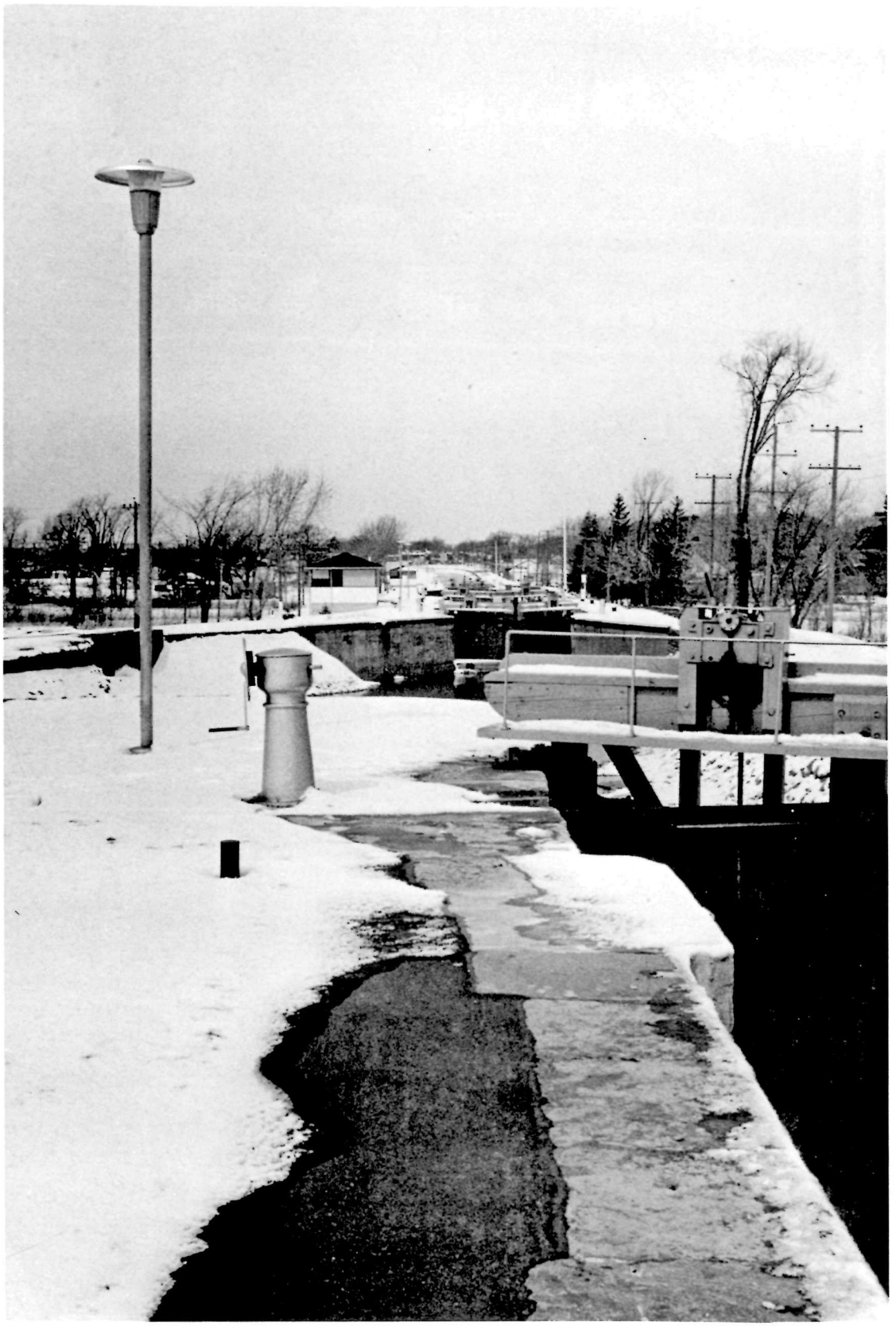
42 Gates at lock 7, 1911. Note the new style of gates at this lock, and the differences between it and the earlier style. (Public Archives of Canada.)


884

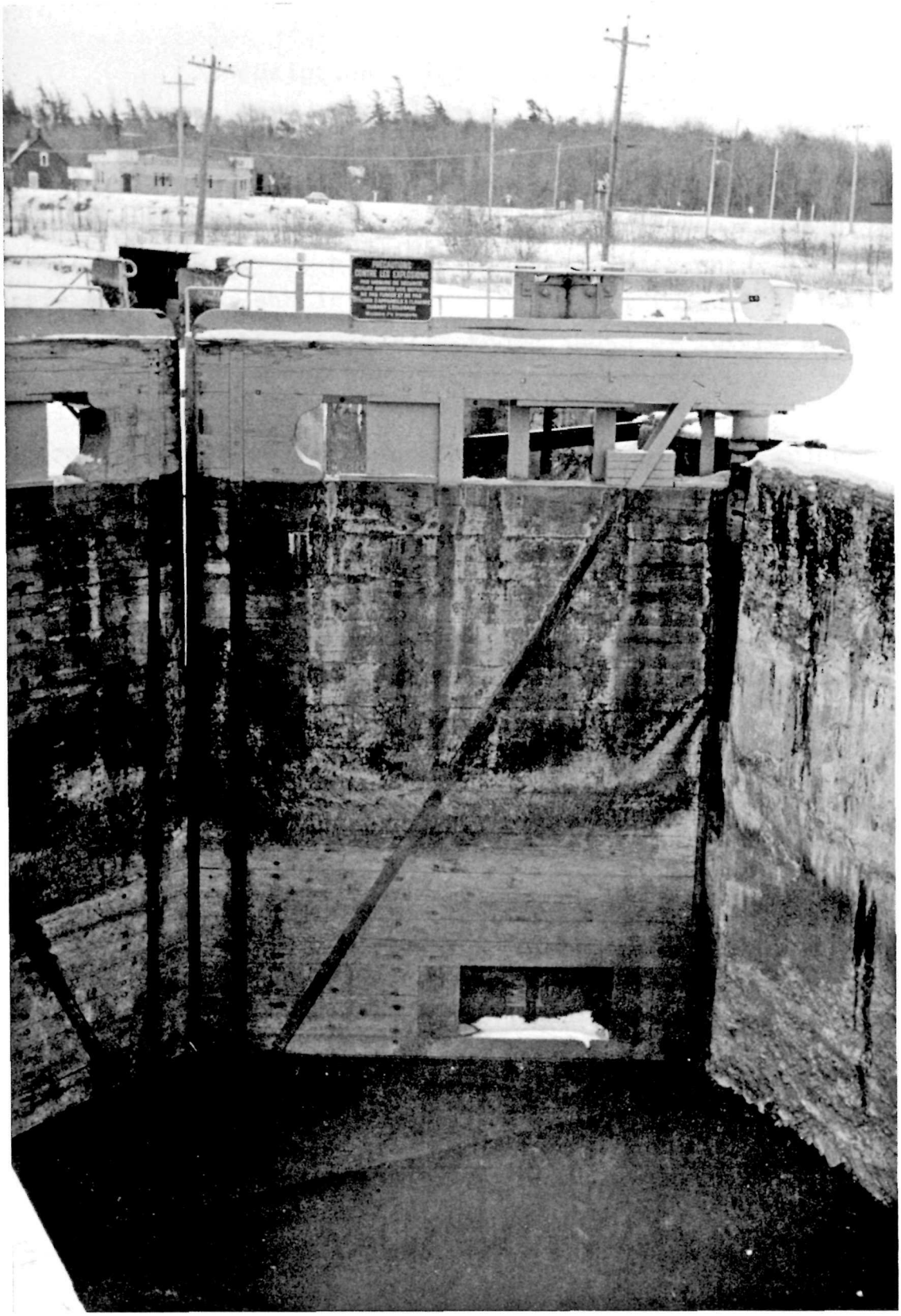
43 Gates and gate mechanisms at the upper west side of lock 4. Note that the gate is not planked on the upstream side. Note also the winches and bars which replaced the crabs and balance beams to operate the gates. (Public Archives of Canada.)



44 The upper west gate at lock 4 in 1973. This is the style of gate in use on the canal today. Note that this gate is still equipped with the old iron railings and the mid-19th century rack and pinions.



45 Gate and sluice-operating devices at the lower west gate of lock 6, 1973.


AVERTISSEMENT
DEFENSE DE FUMER

Appendix A. Peter Fleming's Report, February 1830[1]

Report for a proposed Canal between St. Johns and Chambly Basin, both on the River Richeleiu [sic] in L. Canada.

The River Richeleiu after a course of almost a straight line from its source in Lake Champlain, to the River St. Lawrence, points it out as the natural line of intercourse between this River and the Country bordering the Lake: but the navigation of the River Richeleiu being interrupted by an almost continued fall of its bed betwixt St. Johns and Chambly Basin, which has heretofore formed a complete barrier to a regular navigation on this part, would now be removed by the proposed Canal; and by it open up a valuable and extensive inland communication from the upper extremity of Lake Champlain to the River St. Lawrence - according to the desire of the Hon^{ble} Commissioners appointed to carry this Canal into effect - I have made a complete survey of its Route, and also of the River Richeleiu opposite to it, with the proper levels for to ascertain both the practicability and expediency of this undertaking - In this Report I shall first describe the Route of the proposed Canal and its mode of junction with the River, both at St. Johns and at Chambly Basin, to which I add an estimate of the Expence.

Decription [sic] of the Route

The general levelness of the Lands lying betwixt St. Johns and Chambly: but which varies from fifteen to Thirty feet above the River, has made me consider attentively the preference which should be given to the different practicable Routes, especially those shown by former surveys of other Engineers who have proposed to construct the canal wholly through the solid intervening Land, and which have led me to make the following remarks. It is first evident that supply of water for the Canal must necessarily be taken from the River at St. Johns, and consequently the bottom of the canal here, will require to be the whole of its depth under the surface of the stream at the lowest state of the River - In this view not only the canal itself must be wholly cut out of the solid land, by the above mentioned surveys; but also the whole difference of its water line below the surface of the Country through which it would have to pass, together with that in the angles, which would be required, for the necessary slopes to secure the stability of the faces of deep excavations - Such operations, it is clear, made through a country averaging from 15 to 20 feet above the water line of the Canal would incur a vast expence, both by its actual cutting, and this to be removed wholly from the line of the works - and altogether form a case the most unfavourable and most expensive of canal construction; especially as in this, such would be required for several miles below St. Johns, before sufficient fall could be gained of the Country, to reduce it within ordinary limits; besides the necessary occupation and detioraton of a great surface of land - These considerations led me to examine particularly the beach and bank of the River extending downward, from St. Johns: both of which appeared

to favour the project of forming the Canal along the first, as this is flat and of considerable breadth: also it being little above the level of the lowest state of the River, presented a much less expensive Route than any other heretofore proposed; while the bank along it, is altogether of a loam or clay soil of the best kind for forming a bank for the canal next the stream; and thus require only an expence little more than that which would be required in the most favourable Route - In consequence of these views I have surveyed this new Route commencing at St. Johns Bridge, which leads upon the Beach of the River as stated, for a distance of 7 miles 23 chains, or about the lower extremity of Bunkers hill, with the exception where it cuts a small elbow off, a point of land above this: for the purposes both to shorten the distance here, and have surplus soil to make up a small deficiency of height in the Route opposite to Carpenters tavern on Ferry house: Passing this point it next falls upon the Road betwixt this and Bunkers house by which the Road will necessarily require to be altered about its own breadth behind the Canal.

The Route from opposite Bunkers house proceeds along the Base of a high precipitous bank (Bunkers hill) on which to form the Canal, will require to be cut from the summit, but only as much with a proper slope as will form the Canal bank on the River at its base, and which will also raise the bottom of the Canal equal to the difference its level has gained here by the fall of the River, which is about 8 feet - at the lower extremity of this bank the route crosses the Road the first time where a Bridge over the Canal will become requisite to unite the Road - It next leads upon the west side of the Road, and along somewhat of a hollow ground: but in which, 6 feet at the greatest of extra cutting will be necessary - at the commencement of this part the Rock shows its superstructure which is about level of

the bottom line of the Canal: but this rock is loose and will be easily excavated - from this the Route falls in between M^r Hatts Barn and the Tavern opposite his Grist & Saw Mills: where there will be sufficient room without removing either of these and also for entrance to them - thence it continues across the rear of the farm lots fronting the River, on smooth and favourable ground, the surface of this being about two feet under the water line level of the Canal and whereon the formation will be the least expence - This ground continues for 2-1/3 miles but which terminates at N^O 101 on the plan from which the ground falls off to about the bottom level of the Canal, till reaching an open quarry at N^O-107 nearly opposite the southeron extremity of the Chambly Barracks - On this last part, instead of dropping the Canal by a Lock, I would prefer to make up the banks of the Canal from the adjoining surface and thus terminate the level reach from St. Johns, at this point, making this to be in length 10 miles - Chains

From the Quarry the Route is carried in a straight line, across the Gov^t Common to the front of Bunkers Tavern, and on the west side of this through some unoccupied Lots it makes an elbow and thence falls into the Chambly Basin between Molsons & Bunkers wharfs - its whole length being 11-16/100 Miles -

On the last part or from about N^O. 105 on plan to the Chambly Basin, the whole of the Locks are proposed to be located - this part being favourable for such work by containing Stone Quarries and the whole being hard and dry ground; an examination of the plan and profile of this or other parts of the Route will make the above better understood.

On that part of the Route which extends opposite the islands of St. Theresé by throwing out embankments between them, this branch of the River which is here formed between

these Islands and left bank might be by them dam'd up to the Canal level, and the water of it made to unite with that of the Canal at both the extremities - In this case all that would be then required for the navigation of this part would be a tracking path made out of the left bank; but instead of this method, as the places of the River where these embankments would be are deep water, which with the additional height of the Canal has gained above the stream, which is here about 4 feet 11 inches, it might not be less expensive than the formation of the whole canal along the beach as proposed on this distance: besides the last would leave this branch of the River open for the raft navigation and there may be some propriety in not interfering with the water property of these islands - The first however would have the advantage of acting as a reservoir to the Canal and supply at a middle point the waste of lockage and evaporation in the Canal, which otherwise must always be drawn from St. Johns: but which is not of so much importance in this as were the canal lesser in dimensions - From the freezing state of the River, and the ice not being sufficiently strong to enable me to take the soundings for these embankments, I have not consequently estimated their expence; but only considered this for the Canal continued as proposed along the bank -

Of the Junctions with the River at St. Johns and at Chambly Basin

By inspecting the separate plan of St. Johns on a large scale, will enable the understanding of the proposed junction here, fully better than any verbal description as upon this is delineated in red lines the intended

improvements - which consist of a pier running up from the Bridge after being united to the outer bank of the canal, by which is inclosed as much of the bed of the River on this side as make a commodious Basin for Canal Boats - also along the shore up from the Bridge is a proposed wharf in the rear of the Street Lots, which bounds the Basin on the Town side - The latter unites with the Pier which extends presently down from the south side M^{r}. Motts Hotel: but the outer pier will leave an opening of one hundred feet, by which access will be obtained, for vessels to and from the River - This proposed Basin will inclose the head an old pier, which neccessarily will require to be taken away, also some deepening may be required next the shore wharf, so as to afford sufficient depth for the Canal Boats and others which may come into it.

That part of the Bridge under which the Canal has to pass will require to be strengthened, so as to afford a complete and permanent thouroughfare by it to the outer side of the pier of the Basin - This will be so far obtained by the pier being solid under it - also that part of it betwixt the Canal and Shore, may be likwise solid or filled in, and leaving only a part open for the Canal - These works will of course make the Bridge on this side terminate the outside of them - At a short distance below the Bridge and as much out of the current or bed of the River as possible I have laid down the position of a Guard Lock for the Canal, which will regulate its supply of Water and prevent it from being overflowed by the rise of the freshes of the River - while this will also supply the quantity necessary for the waste of the Canal at its proper level, which should be kept at the level of the lowest state of the River.

The junction with the Chambly Basin as before stated is between Molsons & Bunkers Wharfs - here the water is deepest and remote from the impulse of the rapids - again I must

refer to the enlarged plan of this part instead of written description upon which is delineated, a plan of its entrance into the basin and the position of the first four locks and Bridge upon the Road - By this the first three locks are situated between the Road and the Basin and neccessarily united together with the view to bring the Canal to the ground surface before getting far from the Basin, and consequently by this order one boat must wait untill another pass the first three before it can enter them - The fourth will be above the Road with a part of the Canal betwixt it and the third, in which the Boats may stop before passing into the basin or for other purposes -

The entrance of the Canal into the Basin is projected to five feet water present depth whih can be easily deepened to seven feet - The first and second Lock and also the wharfs at the entrance may be occasionaly covered by the spring freshes; but from them being placed wholly within the bank and wharfs, this can be very little injurious to them, especially as their Gates are thus well protected from drifting or floating ice. In this separate plan I have laid down the sounding of the Basin around the proposed entrance the depth being expressed in numerical feet.

Of Improvements connected with the Proposed Canal and the Navigation of the Richeleiu River below Chambly

Uniting this proposed Canal to the proposed removal of the obstructions on the River below Chambly, will obviously promote a more extensive line of intercourse and afford every facility for inland Carriage along the whole course of these waters: but still while this is afforded by the River

and Canal, the first from its general great depth and breadth forms a considerable obstacle in a cross direction or between the districts of its opposite sides - This would be completely opened by bridges placed upon the River at proper intervals; and there is one point which appears to me would be of great interest and utility in the event particularly of these improvements which is on the Rapids immediately at the upper extremity of the Government Stores. This point is well marked out by a rocky bluf on the opposite side which projects into the River from the opposite bank, and which continues in a substratum across the River - the Rapidity and force of the Current here, especially when charged with Masses of floating ice, shows the inexpediency of proposing a bridge to be of either stone or wood in which a number of piers would be requisite, by which the current and ice might be interupted to their injury or ruin but a Chain Bridge would not be objectionable on this ground - which might be constructed into two parts by the erection of only one stone pier at most in the middle, and its road-way made sufficiently high (as all bridges of this kind are) so as to be above every effect of the Stream - It is clear such a communication at Chambly and directly at the head of the Navigation of the Richeleui and at the termination of the Canal would be of the greatest importance to the opposite Countries.

Peter Fleming

Albany Febr^{y} 1830.

Estimate of Chambly Canal

	£	£
Forming the Canal & Banks from St. Johns Bridge to Chambly Basin 11-1/5 miles at £ 1620		18,144
Three Culverts of wood (a, b, c, on plan) between St. Johns & Carpenters Tavern at £ 40		120
63 small culverts as farm Drains at £ 15		945
12. D° - below Carpenters to Chambly Basin		180
Farm or accommodation bridges 32 at £ 25		800
Small accommodation Bridges to the River		200
A Road Stone Bridge at lower extremity of Bunkers Hill N° 40 on plan		200
A Road Stone Bridge at Chambly		250
10 Locks each of 8 feet lift including the Guard Lock at St. Johns. at £ 2435		24,350
St. Johns Wharf on the Town side and a guard pile wall (pier) next the River or outside of Basin		2,589
To Chambly Wharf & Entrance of Canal		1,215
2 Waste Weirs at £ 75		150
2 Stop Gates on the Canal at £ 50		100
	£	49 243
10 per cent for contingencies		4 924.6
	£	54 167.6

Note. The benefit which the Lands intersected by the Canal, will receive, should compensate for the Land taken, and which is not estimated in the above; but the whole which will be occupied by it which is out of the River will be 73-1/2 English Acres

P. Fleming

Appendix B. Contract for the Construction of the Chambly Canal, 5 September 1831[1]

On the fifth [space left in manuscript] day of September, in the year of our Lord, one thousand, eight hundred and thirty one, before the undersigned Public Notaries duly commissioned and sworn, in and for the Province of Lower Canada resident in the City of Montreal, [space left in manuscript] in the said Province, personally appeared and were present: The Honorable Samuel Hatt, Esquire, Réné Boileau, Esquire, both of St Joseph de Chambly, in the District of Montréal, William Macrae, of the Town of Dorchester otherwise called St. John's, Esquire, and Timothé Franchère, of the Parish of St Mathias, Esquire, [space left in manuscript] being the corporation of the "Commissioners of the Chambly Canal," of the one part, and William S. Shuler, and John A. Sturtevant, all of Amsterdam, in Montgomerie County, State of New York,* Samuel Andres,

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*the said John A. Sturtevant stipulating as well for himself as for and on behalf of Welcome U. Chase, of Amsterdam aforesaid, under & by virtue of the power of Attorney to him given to that effect, bearing date of Amsterdam aforesaid, the twentieth day of August last and annexed to these presents after having been duly signed and paragraphed by the parties and us the said Notaries.

Stephen R. Andres, of St Joseph de Chambly aforesaid [space left in manuscript] of the other part, which said parties to these presents did covenant, promise and agree to and with each other in manner following that is to say -

Whereas it is the intention of the said "Commissioners of the Chambly Canal" in pursuance of the forty first chapter of Statute of the Parliament of the said province passed in the third year of the Reign of his late Majesty King George the Fourth to cause to be constructed and compleated a navigable Canal from a place at or near the town or port of St. John, in the said District to the Basin of Chambly -

And whereas the said parties of the second part are desirous of contracting and undertaking the construction of the said canal in the manner hereinafter expressed -

Now these presents witness that for the price and consideration hereinafter mentioned the said parties of the second part do hereby for themselves and their respective heirs, executors and administrators, convenant, promise and agree with and to the said Samuael Hatt, Réné Boileau, William Macrae and Timothé Franchère [space left in manuscript] as "Commissioners of the Chambly Canal" and their successors, that they the said William S. Shuler, Welcome U. Chase, John A. Sturtevant, Samuel Andres* and Stephen R. Andres [space left in manuscript] their heirs, executors and administrators, shall and will at his and their own proper costs and charges, make, excavate, construct, open and complete a canal with nine cut stone lift locks, and one Guard lock navigable, for boats,

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*Junior

barges, vessels and rafts, from a place at or near the town or port of St. Johns in the said District, at a point or place at any distance not exceeding between twelve and thirteen hundred feet above the bridge at St. Johns towards Lake Champlain to extend through the barony of Longueuil and western port of the Seigniory of Chambly, a space not exceeding eleven and a half miles in length from the Guard Lock, down the river Sorel or Richelieu, to be measured on the line originally located by Wm. R. Hopkins, Esq., to a certain other point or place near Bunkers Hotel at the Basin of Chambly, so as to connect the waters of the river Sorel or Richeleau at the places aforesaid, in conformity to the provisions of the said act of Parliament passed in the third year of the Reign of his late Majesty, and shall and will make and construct the said canal in the most substantial and workmanlike manner, in such manner, and within such time, as are hereinafter expressed and limited, and conformably to the plans and specifications hereinafter mentioned, and at his and their like expence, shall and will do, perform, execute and construct, or cause to be done, performed, executed and constructed, in a good substantial and workmanlike manner, and agreeably in the directions and approbation of William R. Hopkins, Engineer, or other* Engineer or Engineers to be from time appointed by the said commissioners as aforesaid, or their successors, all such necessary lift locks, guard locks, dams, culverts, waste weirs, aqueducts, bridges, sluices, excavations, levellings**, works, matters and things in and about making,

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* the

**Spreadings

constructing and completing the said canal as shall be by such Engineer deemed or considered necessary or proper in relation thereto, according to the specifications hereinafter expressed, and shall and will at his and their own like costs and charges find and provide all and all manner of gravel, stones, lime, cement, nails, lead, iron, brass, timber, wood and all other materials and things of every kind and description whatsoever, and all scaffolding tackle, tools, utensils, labour and workmanship whatsoever, necessary and sufficient, and that can, shall or may be required to be used and done in and about constructing and completing the said canal, and shall and will complete and finish the said Canal, and have the same filled with water and ready and adapted for navigation by boats and vessels on or before the first day of September, which will be in the year of our Lord one thousand eight hundred and thirty four, and in all things agreeably to the specifications or description and particulars hereinafter expressed that is to say - "In all parts of the canal where the cutting is less than eight feet the earth on the surface, (vegetable mould or much) shall be removed to the outer slope of the banks, and all grass, leaves and timber carried without the bank entirely a ditch one foot deep and six feet wide, shall be made under the centre of each bank when the excavation is less than six feet.

The canal shall be made thirty six feet wide on the bottom and have six feet water, have slopes at the rate of one foot perpendicular to two horizontal making the canal sixty feet wide at top water line.

The tow path shall be ten feet wide on top, the birm path to be six feet, both banks on their in edges to be

eight feet* inches above bottom, and to be seven feet nine inches above at the back side of the birm and tow path, where a ditch is to be cut in excavation varying in depth from one to two feet with proper slopes.

All extra earth taken out of the canal or the works connected with it shall be so laid as to do as little injury as possible to the lands adjoining, and must be laid highest next the canal, that the wash may run from the canal; this extra bank (spoil bank) must be ditched and sluices must be made to let off the water that gathers on the tops of the banks at least four in every mile on each side where the canal is not formed by embanking -

Culverts, five in number if required, shall be of stone and covered with** gravel of two feet thick well wet and rammed down - The embankments shall have the same slope with the canal on the inside, and on the outside the slope shall be one foot and a half horizontal to one foot perpendicular - The earth taken from without the body of the canal to form the embankments must come from such points as the Engineer shall direct, and the land from which the earth has been taken shall be left in good shape after the embankment has been removed.

A waste-weir shall be made to have one hundred feet breast and two sluices each five feet by six - It shall be formed of timber mainly and well puddled according to the plan to be given by the Engineer -

There shall be three road bridges and nine farm bridges - the bridge abutments shall be made of rubble masonry, the superstructure of wood according to the plan of the

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Engineer. Bridge embankments to have a gradual slope and be easy of ascent.

Wherever the Canal bank shall be laid in the river, it must be secured by a protective wall either perpendicular or sloped as may be directed by the Engineer, in most places slope wall will be put up except in such parts of the embankments as shall not have been mentioned in the original Estimate of Mr. Hopkins made in October or November one thousand Eight hundred and thirty, - It is however agreed by the parties to these presents that the embankment to be constructed at the head of the Island of St. Therese shall be protected by a substantial slope wall of stone on the upper side, or as the Engineer may direct.

Below water, where a wall cannot be laid, a foundation of Stone must be prepared which on top will be a little wider than the wall it is to support, and slope in each side to the bottom of the river at the rate of one perpendicular to one horizontal. The size of the stone to be used will depend on the velocity of the current - none however shall be admitted of less than twenty five pounds weight -

Wherever embankments are to be made, care is to be taken that they are so sloped and laid from the bottom that the coarse and fine material may be uniformly distributed throughout the bank -

All places in the canal below bottom shall be filled up to bottom with good earth except in those places in which the water on the outside of the banks is usually level with the canal bottom - The wing dam and works at the head of the canal shall be an embankment of stone lined with gravel, running as marked on the map from the guard lock to near Pierces wharf, it must be made of heavy stone, and the earth on the inside of it must be removed to thirty six feet wide at bottom with the usual slopes to six and one half feet below low water mark:-

At Chambly below the lowermost lock an embankment must be made into the basin as far as the point at which six feet water can be had at all times, and the proper canal width excavated to that distance*,

And it is hereby further agreed, covenanted and promised by and between the said parties to these presents that they the said parties of the second part, their heirs, executors and administrators shall and will at his and their own proper expences in all things make and** the said locks for the said canal, conformably to the specifications for the same, hereunto annexed signed by the said parties, and*** form part of the present contract and agreement:-

And the said parties of the second part do hereby declare and agree that they and each of them jointly and severally (Solidairement) and their respective heirs, executors and administrators shall be accountable for the full performance of this contract and by the signing hereof admit that the plans, specifications, descriptions and particulars before referred to are sufficient to their intended purpose, and that without any additional or extra work, other than the works set forth thereby, or necessarily inferred to be done from the general nature and tendency of the plans and descriptions aforesaid, and that the whole of the said works shall be done to the entire satisfaction of the said Engineer or Engineers, and in all respects according to the intent and meaning of the specifications aforesaid, upon every sentence whereof a fair and liberal construction shall be made -

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* down to the depth of six feet below the water

** construct

***to

And the said parties to these presents do hereby further covenant, promise and agree to and with each other that the said works shall at all times during their progress be open and accessible to the said Commissioners and their successors, and shall be carefully examined and inspected, and to prevent all disputes and misunderstanding it is agreed that the said William R. Hopkins, Engineer, or such other Engineer as shall from time* be appointed by the said commissioners or their successors, shall be inspector of the said works; and the said contractors further convenant, provide and agree to and with the said commissioners, that if in the opinion of the said Engineer, they the said parties of the second part should refuse or unreasonably neglect to prosecute the work, or execute, or perform any part of the said works in an unworkmanlike manner or otherwise violate any of the stipulations of this contract, the said Engineer and some of the following persons, that is to say, Benjamin Wright, Canrass White, John B Jarvis and Moncure Robins Engineers to be chosen by the said parties of the second part concurring in opinion with the Engineer of the Commissioners shall jointly have power to determine this contract, and to declare and render the same void and of no effect, and that such determination shall exonerate the said Commissioners and their successors from every obligation imposed upon them by this contract, and that they may immediately after such determination and after a certificate thereof under the hands of such Engineer and of the other person to be selected in manner aforesaid, shall have been deposited or placed in the Office of the said Commissioners

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*to time

proceed to dispose of the whole or any part of the work in the same manner as if these presents had not been made, and if the said parties of the second part shall refuse or neglect to appoint one of the above named Engineers on twenty days notice having been given them by the Commissioners, then the Engineer of the Commissioners shall of himself be competent to declare this contract void, and on his certificate being deposited in the office of the Commissioners they may proceed as above stated to relet the same as if this contract had never been executed, and that to obviate disputes as well as interruption and hindrance to the regular, peaceable progress of the different parts of the work, and to prevent unnecessary injury to the rights and property of the neighbours in the vicinity of the canal, the Engineer shall have the right to dismiss from the service of the said parties of the second part every quarrelsome and disorderly person, and such as shall be addicted to habits of intemperance, or who shall want only commit any unnecessary trepass either upon the person, land, or property of any inhabitant, or other person living, travelling or working upon or near the works of the said canal, and further that if at any time, any overseer, mechanic or workman employed on the said works shall be found unfaithful or believed to be so by the Engineer of the said Commissioners or of their successors, then and in that case the said Engineer shall have power to direct that any such person be forthwith dismissed, and no longer employed by the said parties of the second part on any part of the work:-

And the said parties of the second part further convenant and agree to and with the said commissioners, that if any bad or imperfect materials are brought upon the ground or put in the work and shall be disapproved by the Engineer they shall be forthwith removed to such distance

immediately by the said parties of the second part, the said materials shall be removed at their expence by the direction of the Engineer.-

And the said parties of the second part further promise and agree that they will from time to time during the progress of the work conform to such deviations and departures from the present plans and specifications and variations from the line originally located by Wm. R. Hopkins as near as it can be ascertained, and of any parts of the works as the Engineer may direct, and if the same be to the disadvantage of the said parties of the second part a reasonable allowance shall be made and the amount of such allowance be determined by the said Engineer.

And the said parties of the second part do further covenant, promise and agree, to and with the said commissioners and their successors that they the said parties of the second part shall from time to time during the progress of the works, when required so to do by the Engineer change the places of working.*

And the said parties to these presents do further agree, covenant and promise to and with each other that if any ommissions or errors shall be found to exist in the plans and specifications now made or hereafter to be made and exhibited by the Engineer, by reason whereof and of the not supplying or correcting the same, the said canal might be incomplete, that the said parties of the second

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*It is however agreed between the Said parties that the Engineer shall locate the said canal through the channel - between the island of the St. Thereze and the mainland from a point near the head to a point above a small run coming in near Carpenter's tavern.

part shall not take advantage of any such errors and omissions but that notwithstanding such errors and omissions the said parties of the second part, shall at their proper costs and expences make execute, construct and completely finish the work of every description whatsoever, which may be necessary in and about the said canal, whether the said work shall be comprised in the said plans and specifications or not, according to the true intent, spirit, and meaning of these presents and of the act of Parliament aforesaid.

And in consideration of the said works and agreements so to be finished by the said parties of the second part in manner aforesaid, they the said Honorable Samuel Hatt, René Boileau, William Macrae and Timothé Franchère, [space left in manuscript] Commissioners as aforesaid or their successors shall and* pay or cause to be paid unto the said parties of the second part, their heirs, executors or administrators the sum of forty six thousand, two hundred and eighteen pounds of current money of the said Province in the manner following, that is to say, that on or about one month after the commencement of the said works the said Engineer shall estimate the quantity of the work done and upon his certificate being presented at the office of the said Commissioners, two third parts of the amount thereof shall be paid and on or about the like day of each succeeding month within the limits of the contract, the like estimate shall be made certificate granted, and payment in like proportion made thereon, and further at the period stipulated for the completion and delivery of the said canal, if the whole work shall be finished to the

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*will well and truly

satisfaction of the said commissioners or their successors, the third part or other balance remaining due, shall be paid within twenty days from and after the completion and delivery of the said canal filled with water, provided the said works at that time shall be in perfect good order, and that if any breach or damage shall have occurred to the said works from the time of completion until the time for the final payment, the damage shall be repaired by the said parties of the second part, or the amount of the damage or cost of repairs, shall be deducted from the amount reserved by this agreement; provided also that no greater sum in the whole than the sum of twenty thousand pounds current money aforesaid shall in any one year be paid by the Commissioners, or their successors to the said parties of the second part, their heirs, administrators or executors for or by reason of the premises; and provided also the said parties of the second part shall not call upon or require the said Commissioners or their successors to pay to them any less sum than five hundred pounds at any one time for or by reason of the premises.

And it is hereby further mutually agreed that in case of absence or inability to act of the said Engineer in chief, then and in that case the assistant Engineer having charge of the work embraced in this contract shall have and he is hereby invested with all the powers hereinbefore given to the said Chief Engineer in the premises; and that the submissions herein contained* deemed, and taken as an essential part of this contract, and shall not be revocable by any or either of the parties thereto, and further that the decision of the said Engineer or assistant Engineer

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*shall be considered

shall be final and conclusive in any dispute which may arise between any of the said parties touching the quality of the materials, location of the line and the manner in which the work may be performed, and it is further agreed by and between the parties to these presents, that the Engineer of the said commissioners shall afford every reasonable facility to the said parties of the second part during the progress of the work. And these presents further Witness that Jean B^{te} René Hertel DeRouville, of the Parish of St Hilaire DeRouville, in the said District, Esquire, and Joseph Toussaint - Drolet, of the Parish of St Marc, also in the said District, Esquire, [space left in manuscript] appeared and were present before the said Notaries and voluntarily became parties to these presents, as the Sureties (cautions) of the said parties of the second part -

And the said Jean Baptiste René Hertel DeRouville and Joseph Toussaint Drolet, [space left in manuscript] to hereby bind and oblige themselves severally that the said parties of the second part shall well truly and effectively make, construct, complete or deliver the said canal to the said commissioners or their successors at the time and in the manner hereinbefore expressed, and that they shall in all things observe, perform, execute and fulfil all and singular, the covenants, obligations and promises on their behalf to be observed, performed, executed and fulfilled, according to this tenor and effect, and true intent and meaning of these presents; and they the said Jean Bte René Hertel DeRouville and Joseph Toussaint Drolet [space left in manuscript] do and each of them doth hereby expressly renounce and disclaim all rights and exceptions of discussion and division in the premises provided nevertheless that the said Jean Baptiste René Hertel DeRouville [space left in manuscript] shall not as such surety be bound for or be obliged to pay any greater sum of money than the sum of seven thousand pounds currency; and

provided also that the said Joseph Toussaint Drolet as such surety shall not be bound for or be obliged to pay any greater sum than the sum of one thousand pounds currency -

And the said parties of the second part do hereby further covenant, promise and agree to and with the said commissioners and their Successors that they the said parties of the second part shall as further security for the* performance of this contract cause and procure a bond for the sum of two thousand bounds current money of this Province, of Mathias J. Bovie, Benedict Arnold and Peter Stewart, of Amsterdam aforesaid, and of Marcus E. Reynold, of Albany, jointly & severally as sureties - jointly & severally of the said parties of the second part, to be granted to the said Commissioners and their Successors, on or before the fifteenth day of October next, executed in due form as required by the Law of the State in which the said individuals reside.

And for passing of this deed and for the due performance and execution of the Same and of all and every clause, conditions, stipulations, covenants and agreements therein mentioned and contained, the said parties and each of them have elected their domicile to wit: the said Commissioners and the Said Samuel Andres, Junior, and Stephen R. Andres at their respective places of above mentioned: And the said William L. Shuler and the said John A. Sturtevant as well for himself as for the said Welcome U. Chase at the present domicile of the said Samuel Andres, Junior; For thus & Notwithstanding & Promising & Obliging & Renouncing &.

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*due

Thus done and passed at the parish of St. Joseph de Chambly aforesaid, in the house of the said René Boileau, Esquire, one of the Said Commissioners on the day and year above mentioned, in the afternoon, and the Said parties have signed these presents with us the Said Notaries, after having been duly read according to Law.

Fifteen marginal notes approved are good and Sixteen Words erased are null.

[Signatures are omitted in this report.]

To all to whom these presents shall come William S. Shuler and Welcome U. Chase both of Amsterdam, County of Montgomerie State of New York, Send Greeting - Whereas [illegible] the said William S. Shuler, Welcome U. Chase, John A. Sturtevant, Samuel H. Andres and Stephen Andras have contracted with the Commissioners of the Chambly Canal in the Province of Lower Canada to construct and finish a navigable canal from the port of St. John's to the basin of Chambly in the said Province in pursuance of an act of the Parliament of the Said Province passed in the third year of the Reign of King George the Fourth. - And whereas the convenants, stipulated terms and conditions of the said contract have been settled and agreed upon and have been reduced to writing, and the articles thereof are ready for execution; Now know ye that we the Said William S. Shuler & Welcome U. Case Have made, & constitute and by these presents do make constitute & appoint the said John A. Sturtevant now at Montreal to be the true and lawful attorney of each of us for us and each of us, and in the name of each us, to treat, contract and agree, with the said Commissioners of the Chambly Canal, of and concerning the construction and completion of the said Canal by us and by them the said John A. Sturtevant, Samuel H Andres & Stephen

Andres for and upon such consideration terms and conditions as to the said attorney shall seem meet; and also for us and in our names to make Sign and execute & deliver the said articles of agreement early prepared, or such other contract and agreement as they shall see fit in the premises, either before public Notaries according to the Laws of the Said Province, or otherwise; and generally to make, do, execute and perform all such acts, matters and things, in & about the premises, as he shall think expedient or proper; Hereby severally & respectively ratifying and confirming & promising and binding ourselves at all times hereafter to ratify and confirm, all & whatsoever the said John A. Sturtevant shall lawfully do by virtue of these presents.

In witness whereof we have hereto set our respective hands and Seals at Amsterdam in the State of New York [space left in manuscript] this twentieth day of August - in the year of our Lord one thousand eight hundred and thirty one....
[Signatures omitted in this report]

Signed and paraphed by the parties ne variatur to form part of the foregoing agreements in presence of us Said Notaries at the Parish of St. Joseph de Chambly, this fifth day of September, one thousand eight hundred and thirty one.
[Signatures and specifications for bridges and culverts are omitted in this report]

Specification of the manner of building the Locks of the Chambly Canal.

The Locks shall be so constructed as to have a chamber of one hundred feet long by twenty in breadth and the stone work shall be executed in the following manner.

From the head of the Lock to the nose of the upper hollow quoin shall be eighteen feet. From the upper to the lower quoins shall be one hundred feet, and from the lower quoin to the end of the flooring and of the walls, measured in the centre of the Lock shall be twenty five feet. The upper and lower corners of the Lock walls to be rounded with a radius of five feet.

The walls at the head and foot of the Lock will turn at a right angle to the face and extend into the banks at the head of the Lock they must be carried ten feet back from the rear of the wall, and at the foot to be carried twenty feet back from it: these walls to be of a thickness and to be built in a manner hereinafter mentioned.

The whole of the Lock walls are to be laid on a bed of timber unless a good and firm rock bottom be found. To prepare for laying the timbers, after the Lockpit shall have been excavated, if the foundation be thought bad, the Engineer shall either prepare a plan according to which the Lockpit shall be piled, or he will require of the Contractor to excavate two feet extra depth of Lockpit and to fill this depth again with good gravel well rammed.

Across the head of the Lock a course of sheet pile shall be set by excavating a ditch and placing therein a row of sheet pile and filling them round with puddling they must be formed of two courses of an inch and a half plank, well jointed at the edges, and must extend below the timbers a distance of four feet at least.

Filling round and puddling wherever the Engineer shall conceive it necessary must be done. A puddle ditch shall

also be excavated across the Lock at the lower hollow quoin and also across the foot of the Lock and if necessary another ditch to be made across the Lock at such place as the Engineer may point out [I]n each of these trenches a single row of sheet piling is to be set four feet deep jointed at the edges. All sheet piles to be spiked to the foundation timber with five inch spikes to be used in the proportion of two to every plank.

The foundation timbers may be of any good solid timber, and sufficiently long to to extend through under wall and butress, excepting the timbers next to the sheet pile which must be such as to hold a spike well. The timbers to be twelve inches thick flatted on top and bottom. Those under the mitre sills to be hewed square and laid side by side and when resting on earth or gravel to be well bedded into the pit bottom, they may be laid except those under the mitre sill, six inches apart and the interstices (i.e. spaces) to be filled with gravel, wet, and well cut up and rammed.

The upper faces of the timber to be in the same horizontal plane and be made smooth to receive plank. The upper ends of the sheet pile to be cut off on a level with the upper surfaces of the timbers in such a manner as to form with the plank above a water tight joint.

The foundation timbers to be covered with three inch sound plank, hemlock, pine or oak. From the head of the Lock to the foot and from the centre twelve feet on each side the plank to have their edges and ends planed and fitted to water-tight joints, the remainder may be laid without jointing the whole to be secured to the foundation timbers with tree nails eight inches long and one inch and a quarter diameter in the proportion of two to every four feet in length of each plank.

The mitre sills are to have the form and dimensions as concieved necessary by the Engineer; they are to be secured

to the foundation timbers with six wrought iron bolts two feet long by one inch in diameter as directed by the Engineer.

From the breast of the Lock to ten feet below the lower mitre sill a second course of pine plank two inches in thickness shall be laid within the walls of the Lock and be scribed [?] to them and to the mitre sills and be tightly jointed and spiked down well with five inch spikes.

The walls of the Lock to be of solid masonry laid in regular courses and every part of the face wall, except that at the head and foot of the Lock where the walls return - into the bank and are covered with earth shall be well cut. The walls of the lift Locks to be five feet six inches at the bottom and the same thickness to be carried up six feet, the next five feet shall be four feet nine inches in thickness and the remaining height shall be four feet thick to extend up to the coping which is to be one foot thick and two feet six inches wide.

The walls are to be strengthened by buttresses firmly united and bound to the main walls and raising from the bottom of the Lock to top water line of the upper canal, the buttresses to be four feet by four and placed twelve feet apart measureing from centre to centre. Buttresses to be made twenty four feet in length opposite the upper gates and seventeen feet opposite the lower, they are to be eight feet thick at bottom the offsets in all buttresses to correspond to the offsets in the main wall.

The return of the walls at the head and foot of the locks to be when of cut stone three feet, and when of uncut stone, four feet thick, to extend back to the inedge of the embankment.

The breast of the Lock to be five feet thick with a curve on the lower side of the versed sine of which will be two feet. It is to extend in height from the bottom of one

level to the bottom of the other. The faces of the Ashler to be cut smooth and the beds and joints to be dressed even and in no and in no case shall any stone be more than half an inch thinner on the back than on the face and each stone shall have as much bed as face. The length of the strecher on the face shall be from two to six feet, the length of the headers on the face are not to be less than two feet, and to extend back into the wall three and one half feet, and to be of equal thickness throughout this length.

The walls to be laid in courses not less than ten inches and the light courses to be laid alternately with courses of eighteen and twenty inches; headers shall be placed in the wall not more than eight feet from centre to centre in every course, the headers in the upper courses to be placed over the space between the headers of the lower courses.

The buttresses to be carried up in regular courses with the main walls and to be bound into them by a header on each side in every other courses that shall extend at least two feet into the main wall.

The backing of the walls to be formed mainly of stone of two hundred pounds weight all the interstices between the stones shall be tightly chinked with spails[?].

The ashler shall be set with hydraulic cement, and when laid, the thickness of the morter between the stones shall not exceed the eighth of an inch; As many inches of the face of the wall as shall be required shall be laid in mortar and when required the back of the ashler be mortered tight in order to separate the grout for ashler from the grout for the backing. The morter to be used in the face stone shall either be water lime or common lime as the Engineer shall direct.

The backing of the wall to be laid in morter mixed sometime previous by the contractors and all morter shall

consist of such parts of lime or water lime and well washed sand as the Engineer may direct.

All grout to be mixed up as mortar first and afterwards be made into grout by adding water, in mixing mortar the lime must be carefully run with water from a box that only the fine part of the lime and that which is perfectly slacked that may get into the mortar.

In cutting hollow quoins they must be made from large sound stone, and every other one must extend four feet along the wall and also extend two feet into it.

The coping must be two feet and a half wide by one foot deep, they must be cramped together at the Gates with stout iron cramps well leaded and every two stones to receive an iron dowel one and a quarter inches square, by six inches long, between them.

The Gates are to be of good sound white oak timber free from sap, shakes or other imperfections, and well seasoned, the upper and lower gate bars to have double tenons each and every tenon to be eight inches long and equal in width to the depth of the timber.

The Irons for securing the gates to be of the dimensions required by the Engineer they are to be let into the timber and be secured with screw bolts, an iron band half an inch thick by two inches wide to be fitted to the lower end of the quoin post, and in the bottom of the post a cast iron box is to be inserted and the box and band secured by wedges; a cast iron pedestal and pivot on which the gate is to turn shall be placed under the centre of the quoin post on the flooring of the Lock as the Engineer may direct.

Two cast iron paddle gates or valves shall be placed in every gate, requiring eight for Each Lock.

The valves shall be of the Shape and Size as the Engineer may direct and fitted according to his directions to the Lock gates.

The valve rods are to be of round iron two inches in diameter and of sufficient length to reach one foot above the ballance beam, wrenches or levers will be required to be secured to every gate rod.

Drawings and bills of iron will be furnished for the upper hinges of the Gate as well as for the iron above mentioned; it must be of Russia or Swedes or good Canadian iron or of a quality equal to either.

All parts of the Lock walls not mortared shall be well filled with grout...

[Signatures and notations are omitted in this report.]

Specification of the manner of constructing the combined Locks on the Chambly Canal

The three combined Locks will be constructed on the same plan and in the same manner as the lift Locks except in the following particulars.

The lower gates of the upper lock will be the upper gate of the middle lock, and also the lower gates of the middle lock will form the upper gates for the lower lock.

The upper lock will be 100 feet long from nose to nose of hollow quoins, the lower locks will be one hundred feet between the centre of their breasts and the points of their mitre sills of lower gates.

The walls of the middle lock are to start one foot below canal bottom on a flooring, the upper and middle and if necessary the lower lock timber, are to rest on a system of piles to be driven according to the direction of the Engineer.

The flooring and sheet piling will be similar to the

lift locks.

The upper lock will be fed and the lower lock discharged through the gates with valves.

The middle and lower locks must be supplied by two culverts each, they are to empty on a level with the floor by valves or paddle gates of wood or iron as the Engineer may direct, dimensions to be the same as the culverts in which they are placed being two feet six inches by four feet.

The culverts are to be placed in the centres of the walls in the manner of the Erie Canal locks. Grating, shall be placed also before every culvert opening* of the bars of the grates to be three inches apart and to be of one and a half by three eighths inch iron, secured into the walls in such manner that they can be removed and replaced without deranging the masonry.

The walls from fourteen feet below the lower hollow quoins of each lock are to handsomely stepped off or sloped down and well coped as the Engineer shall prefer.

The two middle mitre sills are to be of cut stone the joints of which are to tend to a centre, and to be formed each of five stones which are to be the full width of the mitre sill (measured in length of lock) and one foot thick well bolted to the breast and each joint dowelled; The back of the Mitre sill to be cut to the same curve as the breast of the Locks...

[Signatures are omitted in this report.]

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*the

Appendix C. The Contract for Enlarged Locks, 1834[1]

Pardevant les Notaires Publics pour la Province du Bas-Canada; résidens à Chambly dans le district de Montréal, Soussignés; -

Sont comparus l'Honorable Samuel Hatt, Ecuyer, Seigneur Primitif de la Seigneurie Chambly & y résident, René Boileau, Ecuyer, notaire résident au dit lieu de Chambly, William Macrae, Ecuyer, collecteur des douanes de Sa Majesté, de la ville de Dorchester communément appelée S^{t} Jean, Timothé Franchère et Eustache Soupras, Ecuyers, tous deux négotians de la paroisse de S^{t} Mathias étant la Corporation des Commissaires du Canal de Chambly, d'une part; -

Et Samuel Andres, Junior & Stephen Reddington Andres tous deux marchands, résidens au dit lieu de Chambly entrepreneurs dénommés en un Certain Contrat pour la Confection du dit Canal de Chambly reçu par devant M^{tre} P.E. Leclere & son confrère, notaires sous la date du Cinq September mil-huit Cent trente & un d'autre part; -

Lesquelles dites parties Se Sont obligées & s'engagent l'une envers l'autre de la manière Suivante

Vu que les Susdits Commissaires nommés pour mettre à exécution l'acte de la troisième année du règne de feüe Sa Majesté George IV, chapitre 41 Concernant le Canal de Chambly, ont l'intention, au désir du trentième chapître du Statut provincial passé dans la troisième année du règne de

Sa présente Majesté Guillaume IV & conformément & au désir d'un Certain acte de la Législature de Cette province passé dans sa dernière session "Intitulé" Acte pour faire de plus amples "provisions pour la Confection du Canal de Chambly & pour d'autre objets y mentionnés relatifs au même objet", de faire agrandir les Ecluses du dit Canal Suivant les dimensions exprimées au susdit trentième Chapître du Statut provincial passé tel que dit est dans la troisième année du Règne de Sa Majesté Guillaume IV.

Et vû que les dites parties nommées en Second lieu désirent contracter & entreprendre l'augmentation des dimensions des Ecluses du dit Canal.

Qu'il soit donc notoire par ces présentes que pour les prix & considérations ci-après mentionnées les dites parties mentionnées en second lieu comme dit est se sont par ces présentes pour eux-mêmes, leurs hoirs, exécuteurs & administrateurs engagés & ont promis et promettent aux dits Samuel Hatt, René Boileau, William Macrae, Timothé Franchère et Eustache Soupras, Ecuyers, en leur qualité de Commissaires du Canal de Chambly & leurs Successeurs qu'ils les dits Samuel Andres, Junior & Stephen Reddington Andres, leurs hoirs, exécuteurs, administrateurs & ayant cause à leurs propres frais & dépens en toutes choses feront parferont & construiront les dites écluses pour le dit Canal des dimensions Suivantes; Savoir, de Cent vingt pieds de long & de vingt quatre pieds de largeur; le tout à être fait conformément & au désir des Spécifications d'icelles annexées à ces présentes & Signées & paraphées ne varietur par les parties et notaires Soussignés pour faire partie des présentes & y avoir recours au bezoin; comme aussi à être fait de la manière la plus Substantielle, Solide & de meilleur ouvrage & Conformément aux directions & approbation de William R. Hopkins, ingénieur ou autre ingénieur ou

ingénieurs, qui Seront de tems à autres préposés & nommés par les dits Commissaires ou leurs Successeurs & fourniront ils dits Samuel Andres, Junior & Stephen Reddington Andres à leurs propres frais & dépens toutes espéces de Sable, pierres, chaux, mortier, ciment, clous, plomb, fer, cuivre, bois, plançons & tous autres matériaux de quelque description qu'ils soient & tous échauffaudages, liens, outils, ustensils & main-d'oeuvre Suffisans, nécessaires & requis pour la Confection de l'augmentation des dimensions des dites écluses, qui seront livrables le ou avant le premier d'Octobre qui Sera dans l'année de notre Seigneur mil-huit Cent trente Cinq -

Et les dites parties mentionnées en Second lieu déclarent par ces présentes & conviennent qu'eux & chacun d'eux conjointement & Solidairement sous les renonciations de droits accoutumés, ainsi que leurs hoirs, administrateurs, exécuteurs & ayans cause Seront responsable de l'entier accomplissement du présent Contrat et admettent par leurs Signatures à celui que les particularités Ci-dessus mentionnées & les Spécifications annexées à Ces présentes & aux quelles elles réferent Sont Suffisantes pour leur dessein projeté, &ce, Sans autre ouvrage additionel que les ouvrages y exprimés ou qui doivent nécessairement être faits d'après la nature & le but général des dites Spécifications & que tout l'ouvrage Sera fait à la Satisfaction pleine & entière du dit ingénieur ou ingénieurs & en tout Suivant & au désir des susdites Spécifictions ci-annexées, Sur chaque phrase des quelles il Sera mis une Construction libérale & juste.

Et les dites parties à Ces présentes conviennent de plus & promettent & conviennent l'une avec l'autre que les dits ouvrages Seront en tout temps durant leur progrès ouverts & accessibles aux dits Commissaires & à leurs Successeurs & Seront Soigneusement examinés & inspectés par

William R. Hopkins ingénieur ou tout autre ingénieur ou ingénieurs qui seront préposés de tems à autres par les dits Commissaires ou leurs Successeurs & s'il arrivait qu'il survînt des difficultés relativement au présent marché, il est convenu qu'elles Seront réglées de la même manière qu'il est pourvu au contrat originaire.

Et en Considération des dits Ouvrages Sus-mentionnées en augmentation des dites écluses & conventions à être exécutées par les dites parties mentionnées en second lieu, eux les dits Samuel Hatt, René Boileau, William Macrae, Timothé Franchère et Eustache Soupras, Ecuyers, Commissaires Comme dit est ou leur Successeurs payeront bien & fidélement aux dites parties mentionées en Second lieu, leurs hoirs, administrateurs & exécuteurs la Somme de Six mille livres, cours actuel de cette province, laquelle Somme Sera payée Suivant & conformément aux termes de payement exprimés au Contrat Sus-daté pour la Confection du dit Canal; Et il est expressément Convenu entre les parties Contractantes que toutes clauses, conditions, Conventions, restrictions, explications & exceptions Spécifiées en l'acte Sus-daté pour la Confection du dit Canal pour la Sureté & garantie du dit acte ou marché Sus-daté Seront les mêmes qui Seront observées au présent contrat pour les augmentations y mentionnées & qui ne Se trouveraient exprimées au présent acte. Et il est aussi Convenu entre les dites parties Contractantes que les présentes ne vaudront que d'autant qu'elles auront reçu l'approbation de Son Excellence ou de toute autre personne le représentant.

Et ces présentes certifient de plus que Masa B. Southwick, Cardeur résident à S^{t} Hilaire de Rouville, Louis Papineau, Ecuyer, Capitaine de milice résident à Chambly comparurent devant les dits Notaires Soussignés & se rendirent parties à ces présentes comme, cautions des dites parties mentionnées en Second lieu & les dits Masa B.

Southwick & Louis Papineau, Ecuyer s'obligèrent conjointement que les dites parties mentionnées en Second lieu feront bien & effectivement, construiront, complétement & délivreront aux dits Commissaires ou à leurs Successeurs les Ecluses sus-mentionnées en augmentation du dit canal au tems & de la manière ci-dessus exprimée & que dans toutes choses ils observeront, exécuteront et rempliront toutes & chacune les conventions, obligations & promesses à être observées, remplies & exécutées envers les dits Commissaires Suivant la teneur & effêt & conformément à la vraie intention & l'esprit des présentes & les dits Masa B. Southwick & Louis Papineau, Ecuyer & chacun d'eux renoncent expressément par ces présentes à tous droits d'exception, de discussion & division concernant les présentes; étant entendu par le présent que les dits Masa B. Southwick & Louis Papineau, Ecuyer ne sont cautions que pour l'Exécution de présent marché.

Et ces présentes Certifient en outre que Gédéon Coursolles, notaire résident à Bel-oeil Comparut devant les dits Notaires Soussignés au nom & comme procureur fondé de Jean Baptiste René Hertel de Rouville, Ecuyer, Seigneur de Rouville pour l'Effêt qui en suit Suivant Sa procuration Sous Seing-privé datée de Ce jourd'hui demeurée annexée à Ces présentes pour y avoir recours au bezoin après avoir été Signée & paraphée ne varietur par les parties & notaires Soussignés, lequel ès dit nom & qualité Consent au présent marché & s'oblige Comme Caution envers les dites parties mentionnées en premier lieu pour les dites parties mentionnées en Second lieu pour le Confectionnement & parachèvement du Canal Susdit avec des écluses de dimensions plus étendues Conformément aux Spécifications ci-annexées Comme Susdit, conjointement avec les dits Louis Papineau & Masa B. Southwick & en la même manière à tous égards que le dit Jean Baptiste René Hertel De Rouville y était tenu quant

au Confectionnement & parachèvement d'icelui, en vertu du marché originaire Comme Susdit & le dit Gédéon Coursolles ès nom & qualité Susdite renonce à tous droits d'exception, de discussion & division concernant les présentes, entendant que le présent Cautionnement donné par le présent ne déroge à celui Spécifié au marché originaire Comme Susdit.

Et pour la passation du présent acte & l'accomplissement & exécution d'icelui & de toutes et chacune des dépendances les dites parties et chacune d'elles ont élu leurs domiciles en leur demeure respective. Car ainsi & Nonobstant, & Promettant, & obligeant, & Renonçant, &c.

Fait & passé à Chambly en l'office d'Augustus Kuper, Ecuyer, le Septième jour de Juillet de l'an mil-huit Cent trente quatre. On les dites parties Comparantes Signé avec nous notaires après lecture faite, ainsi qu'il est en la miute (signé) Samuel Andres, Stephen R. Andres, Samuel Hatt, René Boileau, Thim. Franchère, W. Macrae, Eustache Soupras, G. Coursolles, Masa B. Southwick, Louis Papineau, Joseph Portier n:p: avec paraphe & du Soussigné.

B. Laroque
Not.pub.

Avenant le vingt cinq de Juillet de l'an mil-huit Cent trente quatre, Est Comparu devant les notaires Soussignés du district de Montréal Joseph Toussaint Drolet, Ecuyer, Seigneur de la Seigneurie de Cournoyer, résident en son hotel à S^{t} Marc, lequel après avoir pris Communication & que lecture lui a été faite par M^{tre} Bazile Laroque, l'un des notaires Soussignés du marché ci-dessus & des autres parts écrits & de toutes pièces en dépendantes entre Messieurs les Commissaires du Canal de Chambly d'une part; & Samuel &

Stephen Reddington Andres Contracteurs d'icelui, d'autre part; qu'il a dit bien entendre & Comprendre, en est Content & Satisfait, l'a ratifié & ratifié par le présent Comme étant Suivant Son intention & volonté, veut & entend qu'il Sorte Son plein & entier effet & soit suivi & exécuté Suivant Sa forme & teneur & s'oblige par ces présentes Sous l'hypothêque de tous ses biens présens & à venir Comme Caution des dits Samuel Andres, Junior & Stephen Reddington Andres Conjointement avec Louis Papineau, Ecuyer, Masa B. Southwick, Jean Baptiste René Hertel De Rouville, Ecuyer envers l'Honorable Samuel Hatt, René Boileau, William Macrae, Timothé Franchère & Eustache Soupras Ecuyers parties mentionnées en premier lieu au marché ci-dessus & des autres parts écrit pour le Confectionnement & parachèvement du Canal susdit avec des écluses de dimensions plus étendues Comme exprimées au marché ci-dessous & ès autres parts à être délivrées aux Commissaires du dit Canal ou à leurs Successeurs à l'époque & de la même manière que déterminé au susdit marché ès autres parts & conformément aux Spécifications ci-annexées après avoir été par lui Certifiées véritables & signées ne varietur & le dit Joseph Toussaint Drolet, Ecuyer renonce à tous droits d'exception, de discussion & division Concernant les présentes, entendant que le présent Cautionnement par le présent donné ne déroge à Celui Spécifié au marché originaire.

Et pour l'Exécution des présentes, le dit Joseph Toussaint Drolet, Ecuyer, a élu son domicile au lieu susdit, auquel lieu, Car ainsi, & Nonobstant, & Promettant, &c obligeant, &c Renoncant, &c.

Fait & passé à Chambly en la maîson de René Boileau, Ecuyer, les jours & an susdits. A le dit Sieur Comparant Signé avec nous notaires, après lecture faite ainsi qu'il est en la minute (signé) J.T. Drolet. Théophile Lemay n:p:

B. Laroque
Not:pub.

Je soussigné faits & appointe par ces présentes pour mon procureur Spécial M^tre Gédéon Coursolles notaire, auquel je donne pouvoir de pour moi & en mon nom Se transporter à Chambly pour prendre Communication du Contrat qui doit se faire entre Messieurs les Commissaires du Canal de Chambly d'une part & Messieurs Samuel & Stephen R. Andres Contracteurs d'autre part & de Consentir en mon nom au dit Contrat & m'obliger moi & mes biens Comme Caution des dits Contracteurs conjointement avec Joseph Toussaint Drolet & Louis Papineau, Ecuyers, & S^r Masa B. Southwick le tout Conformément & au désir de l'acte du parlement provincial passé dans la quatrième année de règne de Sa Majesté Guillaume Quatre Chapître XI, Intitulé "Acte pour pourvoir à des dispositions ultérieures afin de parachaver le Canal de Chambly, & pour d'autres fins y mentionnés, qui ont rapport au même objet" Et Je promet d'avoir le tout pour agréable & le ratifier à demande si bezoin est - Enfoi de quoi J'ai signé le présent à S^t Hilaire De Rouville Ce 7^me jour de Juillet 1834

(Signé) Hertel De Rouville

Signée & paraphée no varietur par les parties & notaires Soussignés pour y avoir recours au bezoin au désir de la mention faite au Contrat Ci-Contre annexé daté de Ce jourd'hui Septième jour de Juillet mil-huit Cent trente quatre

(Signé) Samuel Hatt, René Boileau, Samuel Andres, Stephen R. Andres, G. Coursolles, Tim. Franchère, W. Macrae, Masa B. Southwick, Louis Papineau, Eustache Soupras,

(Signé) Joseph Portier & Basile Laroque, notaires publics

B. Laroque

The locks are to be made and the work to be carried on in the manner & form described in the Specifications made and Signed on the fifth day of Sept. 1831 except in the following particulars

From the head of each lock to the nose of the upper hollow Quoin Shall be twenty two feet; from thence to the nose of the lower hollow Quoin Shall be 120 feet; & from there to the end of the lock in Straight line Shall be 25 feet

Ten feet above the head of the lock a row of Sheet piling Shall be set to extend the whole width of the lock & its wings; to be covered with a flooring of 2 inch plank passing under the masonry & resting on 3 timbers & trenailed to them.

A row of wing piling is to go from each Side of the lock wall at the head to twenty five feet above it and a protection wall of Stone to be laid from the foot of the lock on each Side of the Canal to 150 feet below the lock

From the head of the lock to the foot & from the Centre of the lock 14 feet on each side the plancks Shall be tightly jointed & pinned to the timbers by tree nails 8 inches long to the number of 9 in each planck

The mitre Sills are to be secured by from ten to 14, 1-1/2 inch square bolts as the Engineer may direct

The lock walls to be laid as follows the first 8 feet in height of wall Shall be 6 feet thick, the next 4 feet Shall be 5 feet thick & the next 4 feet, in height extending to the Coping Shall be 4 feet thick

The Butresses Shall be 12 feet apart from Centre to Centre or as near that as the Space to be Supported by butresses Can be divided

The upper butress Shall be made 24 feet long & the lower long butress Shall be 20 feet long

The Breast is to be cut to the Same radius as was intended for the former plan of locks

The in bond hollow Quoin Shall be at least 3-1/2 feet in bed from the deepest part of the cut work & Shall bond and be bonded 1 foot at every joint.

Two rods are to be placed in the wood work of the gates one from the lower corner of the toe post to the head of the heel post the other across the top of the gate as the Engineer Shall direct.

Combined Locks

The combined locks are to be made like the lift locks when they have the Same lift the lower lift lock which raises [11] feet Shall have walls 7 feet thick at base diminishing in proportion to the others being Stronger in the most exposed points

The Culverts are to be so laid in the butresses that they may have 4 feet of wall on each Side of them; the butresses to be Strengthened where they pass & under them that they may have this Strength of wall around them whatever their form may be and the locks are to be finished by the plans & directions of the Engineer

Appendix D. The Andreses' Claims, 1835[1]

Statement of Extra Work done on the Chambly Canal by Samuel Andres Jun[r] & Stephen Reddington Andres Contractors to the 1st day of October 1835

From the Honorable R. Jones' Bridge to the Guard Lock the Bank at Present Contains pr agreement it would have Contained	25561 yds 9373 do				
increase	16188 do	1/9	1416	1	3
Section No 1, at present contains pr. agreement it would have Contained	47003 do 15979 do				
increase	26024 do	1/9	2277	2	
1620 Perches protection, Stone Wall Section No. 2, at present Contains pr. agreement it would	41771 do				

have contained	18620 do				
increase	22651 do	1/9	1981	19	3
1475 Perches protection		11/3	829	13	9
Stone Wall Section No. 3, at present Contains	27851 do				
pr. agreement it would have contained	13880 do				
increase	13971 do	1/9	1222	9	3
1936 Perches protection		11/3	1089	9	3
Stone Wall Section No. 4 at present Contains	30229 do				
pr. agreement it would have contained	16720 do				
increase	13509 do	1/9	1182	"	9
1898 Perches protection,		11/3	1067	12	6
Stone Wall Section No. 5 at present contains	37955 do				
pr agreement it would have contained	17100 do				
increase	20855 do	1/9	1874	16	3
1511 Perches protection,		11/3	849	18	9
Stone Wall Section No. 6, at present Contains	22649 do				
pr. agreement it would have contained	17226 do				
increase	5423 do	1/9	474	10	3
1787 Perches protection Stone Wall		11/3	721	2	6
Extra Paddle Gates & putting Same on			75	2	"
do Cost of an Iron Bridge at Demerses			500	"	"

do Excavation on Section No. 4 Lower Division		5	3	6
do Cost of Waste Weirs		300	"	"
do do of large Stone Culvert on Section, No. 10		37	10	0
do do of Putting up 4 Farm Bridges		257	3	6
Quarrying and cutting hard Stones for Locks		201	2	11
37 Yds. Excavation in Upper Trench of Lock No. 1	2/5	4	18	8
117 Feet of Timber For Same	3d	1	8	8
500 feet of planks for same	9/	2	5	0
Carried Forward	£ 17237		10	1
250 Boards for Lock No. 1	5/		12	6
Spikes and Nails used for same		1	7	6
Puddling upper Sheet piles of Same		1	5	0
Carpenters labor on Same		1	5	"
36 Yards Excavation in lower trench of same		4	16	"
500 feet of Timber for extra width of same		18	10	"
79 feet of Check Cut in Same	at 5/	19	15	"
Coping on Check of Same		1	10	"
Backing Coping with Masonry		1	15	"
5 Barrels Cement for laying Copeing	17/6	4	7	6
Putting down timbers in extra width of Same		5	"	"
Pumping water during operations on same		9	15	"
12 days of an overseer with board	at 12/6	7	"	"
220 perches of Stone Work	15/	165	"	"
Tree nailing in Lock No. 1		5		
860 Yards Embt on Section No 10				

Lower division	1/	43	"	"
Digging Puddle trench on Section No. 9		5	"	"
Raising Berm Bank on Section No. 8		5	"	"
94 Yds Excavation, on Puddle trench Section 7	2/8	12	10	8
150 days Laborers working on mud & water inclg Overseer on Section Nos. 6 & 7	3/9	28	2	6
Roads & Bridges on Sections Nos. 3 & 4		493	18	6
Culvert across the Road on Sections No. 4		40	"	"
Roads on Sections Nos. 1 &2		65	10	"
Mr. Henshaw's Road		90	"	"
Culvert No. 1		37	10	"
Building Bridges & bushing road at Magott's		7	10	"
Dyke near Culvert No. 1 to form Road		12	10	"
Roads Bridges &c in Upper Division		578	"	"
Culling Lock Wings of Lock No. 4		"	7	9
Excavating and backing, for Ditto		17	8	9
17 Paddle Gates . . . 1751 lbs at 27/6 pr cwt		22	9	11
Putting Same into Gates		3	17	6
204 lbs Bolts & Nuts for stone weights to Balance Gate		5	2	"
136 lbs Bolts & Straps for Ditto to Bridges		3	8	"

20 Paddle Gates Springs to Lock No. 1 & 2		7	10	"
12 days of a Carpenter Making Models		4	14	9
Making Models for Castings for Bridge		3	4	3
Stone Sluice laid in No. 5 Upper Division		2	15	
332 feet Cut Stone in Locks 2, 3 & 4	at 5d	6	18	4
48 days Laborers assisting Engineer	at 2/6	6	"	"
carried forward	£	18,931	16	6
1/2 day of a Blacksmith at St. Therese	at 7/6	"	3	9
1-1/2 do of a Carpenter at ditto	"	"	11	3
260-3/4 yds Excavation in Lock pit of Guard Lock		16	5	10
138 feet 8 inches Cut Stone Work in Same	at 5/	34	13	4
32 feet Excavation in Same		1	10	"
126 feet Stone Work in Same	at 7/	12	12	4
3907 feet Ashlar	at 6d	97	13	6
32 piedes Cut Stone to balance Lock gates	20/	32	"	"
35 feet Stones to Balance Bridges		5	7	6
Alterations on Bank at Wood's Creek		25	10	"
Excavation on Ditto		55	"	"
Alterations on Bank between Quarry & upper Dyke		90	"	"
Extra earth put into Bank at Mr. G. Marchand's in Consequence of Deep Water		325	"	"

Dressing face of Bank above Guard Lock		18	"	"
216 Perches protection Stone Wall above Mr. G. Marchand's Stone being on hand	7/6	81	"	"
85 days of Laborers Making Roads & Drains		12	9	"
6 do of overseer on same	at 5/	1	10	"
16 do of under-overseer on ditto	at 3/6	2	16	"
40-1/2 do of Laborers on Section No. 4	at 3/	6	1	6
61-1/4 do of do taking off Bank for Waste weirs		7	12	6
4 do of a overseer on same	5/	1	"	"
3 do of a carpenter Selecting Timber	6/3	"	18	9
1070 Yards Embankment on Section, No. 1		63	15	"
Extra Excavation on ditto		76	10	"
Making slope on Birm-Bank & Extra Width of Canal bottom on Section No. 2		200	"	"
Making Bank opposite Haywoods house		175	"	"
Bank above Mr. G. Marchands		75	"	"
Excavating below Canal bottom		50	"	"
511 days of labourers pumping Water	2/6	62	10	"
241 Yds Embankment on Section No. 11	5d	5	0	"
300 Yds Excavation on Same	"	6	5	"
300 Yds filling in Lock pit, equal to 240 Yds of Embankment, at 5^{d} p yard		5	"	"

500 feet Timber for Extra Width of Lock No. 1	6	5	"
555 Yds Excavation in Slate being in the additional width of same	74	"	"
	£20,558	16	5

Appendix E. The Contract for Completion of the Canal, 1840[1]

Making a Canal from St. John's C.E. to the Bassin de Chambly.

On the Eleventh day of August in the year of Our Lord one thousand eight hundred and forty. Before the undersigned Public Notaries duly commissioned and sworn in and for the Province of Lower Canada residing in the city of Montreal, in the said Province.

Personally came and appeared and were present, William Lauder of the said City of Montreal, Master Mason, John Whitlaw of the same place, Master Carpenter, and William Tennant also of the same place Master Mason; all parties hereto jointly and severally of the first part; and the Honorable Samuel Hatt of Chambly; William Macrae of the town of St. Johns, Eustache Soupras and Timothé Franchére both of St. Matthias and Hamilton H. Killaly of the city of Montreal in the District of Montreal, Esquires, Commissioners duly appointed by Letters Patent under the Great Seal of the said Province in virtue and for the execution of an act of the Legislature of the said Province passed in the third year of the reign of George IIII chapter 41, intituled "An Act to grant an aid to His Majesty for the purpose of making a navigable Canal, from or near the town of St. Johns to the

Basin of Chambly upon the River Sorel or Richelieu" and as such Commissioners for the execution of two certain ordinances of the said Province passed in Special Council in the second and third years of the reign of Queen Victoria, the former, chapter 61 intituled "an ordinance to authorize the Commissioners for making the Canal from Saint Johns to Chambly to borrow a certain sum of money to complete the said Canal["] and the latter, being chapter 22 intituled "An ordinance to amend and latter render permanent an ordinance passed in the second year of Her Majesty's reign, intituled "An Ordinance to authorize the Commissioners for making the Canal from St. Johns to Chambly, to borrow a certain sum of money to complete the said Canal"; parties hereto of the second part,

Which said parties to these presents did declare unto us the said Notaries to have covenanted, contracted, and agreed to and with each other, in the manner and form following, that is to say:-

The said William Lauder, John Whitlaw and William Tennant did and they do by these presents jointly and severally, solidairement contract, promise and agree and undertake, and bind and oblige themselves toward the said Commissioners and their successors in office, accepting hereof, to make, erect, construct, build, complete and finish after a neat, substantial and workmanlike manner, the whole of the works, composed of stone, wood, iron, lead, earth and every other material required, in the making, finishing and completing of such parts of the said chambly Canal, and being those parts or portions thereof and in and about the same, which are included and comprehended or compose the Sections numbered one, two and seven in a printed "Schedule of Divisions of work for the completion of the chambly Canal" hereunto annexed marked A, which said three sections or divisions of work hereby contracted for to

be done and performed by the said party of the first part, are known and described as follows to wit:-
"Section 1 - Three combined locks, and excavations for "the same at chambly basin, according to plans, sections "and specifications (Gates not included) puddling behind "the Lock walls, - filling in behind the Locks and embank- "ing where necessary around the same; Excavation of "Canal entrance from lock outwards about three hundred "feet in length above and below water level, construction "of a pier three hundred feet in length, eighteen feet "wide, of Crib or pile work as may be decided on, to "stand about six feet above low water mark, construction "and removal of the necessary coffer dam &c.
"Section 2 - Construction of embankment and excavation "from No. 5 lock, according to section: formation of "Basin as staked off on the ground to head of combined "locks; removal of temporary dam at termination of present "Canal and completing the bottoming of the same up to "No. 5 lock, with raising embankment where necessary "dressing slopes &c." [and] Section 7. - Excavation of "entrance basin at St. Johns to the required depth, with "the necessary coffer dams, with the removal thereof, with "the construction of the wharf along the basin, raising "outer bank to the required height"
and protecting the back of the same with stones and pavement. It being understood that the coffer dam at chambly termination embraces within it, the full breadth of the excavation both of the channel entrance as well as for the seat of the wharf.

It is hereby also contracted and agreed that all the said works shall be made and done after the most substantial and neat workmanlike manner possible and all the materials therefor furnished and provided, shall be in every particular according to the specifications thereof hereunto

annexed, marked B, identified by the signatures of the said parties hereto and of us Notaries, and hereby made meant and intended to form part and parcel of these presents as fully as if the same were herein embodied, the said parties hereto of the first part, hereby promising and binding themselves to strictly conform thereto, and to every item thereof, clause, condition and limitation therein set forth and contained.

Also, that all the materials of every description, labor and workmanship, all implements, tools, cartage, engines, pile engines and every matter and thing soever needful and requisite for carrying on, managing, conducting and finally accomplishing the whole of the said works according to the said Specifications annexed, and these presents shall be by the said parties hereto of the first part found, furnished and Provided by and at their own proper costs, charges, risk and expenses, and shall be and continue to be at their own entire personal risk.

And the said parties hereto of the first part do further hereby bind and oblige themselves to commence the said works forthwith after the date hereof and to continue thereat without interruption with a competent number of mechanics, workman and laborers to the end that the whole thereof shall be fully and finally finished and completed, and to the entire satisfaction of the said parties hereto of the second part or to their successors in office for the time being, and to their Engineer or person appointed by them to superintend the same; and the whole thereof shall be so delivered by the said party of the first part according to the true intent and meaning hereof on or before the first day of the month of November in the year one thousand eight hundred and forty-one on pain of all costs, charges and damages.

Also it is agreed that during the progress of the said

Works, they shall be subject at all times and from time to time to the inspection, rejection and direction of the said Engineer and superintendent appointed for the time being by the said parties hereunto of the second part, which said Engineers or superintendents shall have the right of rejecting all unsound materials or improper work, and which shall thereupon be immediately removed from the said Works upon his or their order and direction and replaced by sound materials and workmanship at the expense, risk, costs and charges of the said party of the first part. It is further expressly agreed and understood by and between all the said parties hereto that the said Commissioners, parties hereto of the second part, shall at all times have the right to add to and to diminish from any part of the said contract and agreement and the works hereby contracted and agreed for; also that should any misunderstanding arise as to the quantity of work or to the true intent and meaning of the said annexed specifications the same to be left to the engineer, whose decision thereon shall be conclusive and binding on all parties, in all cases.

The present contact and agreement is thus made by and on the part of the said party hereto of the first part, for and in consideration of the following rates and prices (being the rates and prices tendered by them for the performance of the said Works) that is to say,

For Lock Masonry at the rate of one pound thirteen shillings currency per cubic yard for excavation above low water-level in lock pits, one shilling per cubic yard, and in Canal and basin above low-water level ten pence per cubic yard-

For excavation below low-water level in Lock pits, one shilling and six pence per cubic yard; and in basin outside including coffer dam at three shillings and two pence per cubic yard -For Rock excavation in line of Canal, two

shillings and six pence per cubic yard. For embankment, ten pence per cubic yard-

For puddling behind the Lock Walls one shilling per cubic yard-

For sheet piling two pounds one shilling and eight pence for each one hundred superficial feet-

For bearing piles, ten shillings per pile.

For flated timber for foundation of locks, including costs of pounding and filling in between, three pounds two shillings and six pence for each one hundred feet lined.

For four inch planking for the same complete five pence per superficial foot.

For wooden sills of oak five shillings per cubic foot.

(Wharf at St. Johns.)

For driving piles and completing the wharf at St. Johns according to specifications, complete, one pound seven shillings and six pence per lined foot at wharf.

For excavation from basin including the expense and removal of coffer dams two shillings per cubic yard.

For lining the embankment both sides, as specified in specifications, fifteen shillings per lineal yard.

It is hereby particularly understood and agreed that in the foregoing prices, is included all cost & expense in making, keeping up and removing all necessary coffer or other dams, and of keeping out water, which shall be done by the said party of the first part so effectually as to allow the works to be laid dry.

All such iron and lead work as may be necessary or directed by the said Engineer during the progress of the said works to be done and furnished, shall also be made, furnished and executed by the said party of the first part, at the rate and price of six pence currency per pound weight

of iron work, and six pence per pound weight for lead work -

All which said rates and prices the said Commissioners, parties hereto of the second part for themselves and their successors in office shall and will pay or cause to be paid to the said parties of the first part or to either of them (the receipt for the same, by any one of them being binding on the others) in and by monthly payments as the said works shall advance in the proportion of ninety pounds currency, for each one hundred pounds of work done and performed; the said payments to be made within ten days next after the date of the certificate of the said Engineer being furnished certifying the quantity of work done, which shall be necessary before any payments can be made - the balance or residue of the said considerations or prices shall be by the said party of the second part, with-held or retained as an additional security to that hereinafter given, until the full and final completion and delivery of all the said works hereinbefore contracted for in manner aforesaid, to be paid unto them by the said party of the first part within ten days next after such delivery, and the acceptance of all the said work, less the allowances hereinafter mentioned.

It is also hereby understood and agreed that the said parties of the first part shall have and take all the ashlar stone belonging to the said Commission, now on the ground and along the sides or banks of the said canal, or wherever else they may be found and which may be required for and admitted by the Engineer to be suitable to the construction of the said locks, and shall allow to the said Commissioners in deduction of the aforesaid rates and prices, at the rate of two shillings and four pence per superficial foot, for the rough ashlar and two shillings and nine pence per superficial foot for the cut ashlar not requiring redressing measured on the face.

And shall, also make to the said Commissioners a

further allowance for all rubble backing, stone heretofore prepared for the works of the said Canal and now available at the rate of one pound fifteen shillings per toise.

It is also agreed that the measurement of embankment shall be nett bank, no allowance for subsidencies or shrinkage being made, and that the measurement of lock masonry shall be the sold Cubic contents without any allowances.

And at the time of making and passing these presents, personally also came and appeared Dougald Stewart of the said City of Montreal, Merchant and John Ross of the same place, plumber and lead Merchant intervening parties to these presents who declared themselves, to become jointly and severally personally bound as Security for, and solidairement with, the said William Lauder, John Whitelaw and William Tennant renouncing to the rights and benefits of division and discussion toward the said Commissioners parties hereto of the second part, accepting hereof for themselves and their successors in office, for the due and faithful performance and fulfilment of the foregoing Contract and agreement and of all and every the Covenants, clauses, conditions and agreements therein set forth & contained, thereof they the said Dougald Stewart and John Ross, have made their own affair as principal obligars, under the Special Mortgage and hypothecation of all and singular their and each of their real and personal property present and future one obligation not derogating from the others.

Provided always and it is hereby, nevertheless expressly agreed and understood that the liability of the said Dougald Stewart and John Ross as such securities solidaire as aforesaid and hereby created shall not exceed the sum of four thousand pounds currency recoverable against them their executors, curators and administrators,

For thus &.-

And for the execution of these presents the said parties have elected their domiciles, to wit: the said parties of the first part at the house of the said John Whitelaw in the said City of Montreal, the said party hereto of the second part, at the office of the Board of Works in the said City of Montreal, and the said Dougald Stewart and John Ross at their respective places of residences in Montreal - At which places &c-

Done and passed at the town of Dorchester commonly called St. Johns in the County of Chambly in the District of Montreal in the house of James E. Mott Innkeeper (on the day, month and year first above written in the afternoon and signed by all the said parties with us the said Notaries on the original minute to be and remain of record in the office of Henry Griffin one of the said Notaries at the City of Montreal aforesaid after being duly read -

(signed) Wm Lauder
" John Whitlaw
" William Tennant
" Dougald Stewart
" W. Macrae
" Samuel Hatt
" Hamilton H. Killaly
" Eustache Soupras
" Thim. Franchere

Thomas J. Patton N.P. H. Griffin N.P.

A true copy of the original minute remaining of record in my office.

(Signed) H. Griffin N.P.

Schedule of Divisions of Work for the completion of the chambly Canal -

A

Section 1. - Three combined Locks and excavations for the same at chambly Basin, according to plans, sections, and specifications (Gates not included); Puddling behind the Lock Walls; Filling in behind the Locks and embanking where necessary, around the same; Excavation of Canal entrance from Lock outwards, about three hundred feet in length, above and below water level; construction of a pier, three hundred feet in length, eighteen feet wide, of Crib or Pile Work, as may be decided on, to stand about six feet above low-water mark- Construction and Removal of the necessary Coffer Dams, &

Section 2. - Construction of Embankment and Excavation from Number 5 Lock, according to section; formation of Basin, as staked off on the ground, to head of combined Locks, Removal of Temporary Dam at termination of present Canal and completing the bottoming of the same up to No. 5 Lock, with raising Embankment where necessary, Dressing slopes &c

Section 3. - Taking down and rebuilding Lock No. 1 (Dubuc's) to twenty four feet wide, and in other respects according Specification

Section 4. - Rebuilding the abutments or Wing Walls of Four or more swing Bridges, with hammer dressed, coursed abutment walls, Rebuilding or Repairing such culverts as may be required hammer dressed work; pitching with Land stones the different conduits down Canal Slope, to carry flood water into the Canal, where the same cannot be conveyed by Culverts,

Section 5. - For such excavation as may be required for widening or Deepening the Canal to thirty-six feet bottom,

or such width as may be determined on, specifying a rate for earth or rock. The materials to be at the disposal of the Commissioners.

Section 6. - For the delivery on the North Bank of the Canal (but as near as practicable to the Canal) four hundred Toises, more or less, Land Stone or Quarried Material, to be delivered between the Guard Lock near St. Johns and the head of the Island or Upper Dam, within two months commencing from date of agreement.

Section 7. - Excavation of entrance Basin at St. Johns to the required depth, with the necessary Coffer Dams with the removal thereof, with the Construction of the Wharf along the Basin, raising outer Banks to the required height.

Tenders to express the Rates for the Execution of the above Works according to form of Tender.

Two good and sufficient Securities will be required for the due fulfilment of the Contracts.

Specifications of the work to be seen at this office, at the office of the Board of Works, Montreal, and at the office of the undersigned, in Cobourg U.C.

(Signed) N.H. Baird,
Civil Engineer,

Canal office, chambly 3^{d} July 1840.

Printed Schedule A "of divisions of Work for the completion of the Chambly Canal" referred to in the annexed contract and agreement identified by the signatures of the parties thereto and of us notaries at the time of the Execution thereof this 11th day of August 1840.

(Signed) Wm Lauder
" John Whitlaw
" William Tennant
" Dougald Stewart

" John Ross
" Wm Macrae
" Samuel Hatt
" Hamilton H. Killaly
" Eustache Souprons
" Thim. Franchere

Thomas J. Patton N.P. H. Griffin, N.P.

A true copy.

(Signed.) H. Griffin, N.P.

B

Specification for the combined Locks &c, at the chambly Basin - The chambers of the Locks to be dimensions corresponding with those already constructed, say 24 feet in width between the piers, 120 feet in length from pointed cill to Breast works & having 6 feet water over the mitre sill with the exception of the entrance Lock from the Basin, which shall have seven feet at lowest water, this is to be assumed at 4 6 below 25 June mark, which will be pointed out on the spot -

The Basin Lock to have	11 - 6 feet
Centre Do	10 . 6 "
Upper Do	10 . 3 "
Making in all Lockage	32 . 3 "

The Foundation of these Locks to be secured in the following manner. Should the Excavation at the required depths respectively be deemed sufficient by the Engineer, to dispense with inverted arches, to have 7 longitudinal sleepers of Hemlock, Pine or Tamarack, flatted on two sides to not less than one one foot in depth, and laid in trenches to be dug out of the solid, to be properly filled in and rammed so as to insure the Logs a solid bed; those sleepers to extend so far under the Breast work, as shall be

considered necessary by the Engineer, or person, superintending the works.

On these longitudinal sleepers, transverse timber of similar dimensions and quality, to be laid extending across the Lock foundation to the extremity of counterforts, sluice piers and wing walls, these timbers to be properly hewn on two sides only, so as to ensure their laying evenly and with equal bearings throughout on the longitudinal.

The Transverse Timbers to extend to the extremity of the Longitudinal, These transverse sleepers to be placed not exceeding four feet from centre to centre and to be well filled between with clay properly pounded in so as to form a compact solid, packing: When properly levelled off to receive 4 inch planking in lengths of not less than 24 feet, to be close jointed; the plank not to exceed 9 inches in breadth free from waine or sap; to have 2 square treenails in each sleeper, the butt ends to be spiked down with 2 nine inch wrag spikes headed with oakum.

The whole to be done in a workmanlike manner and to the satisfaction of the Engineer.

In addition to the Transverse timber already described should it be found necessary, 9 feet lengths of similar stuff to be introduced, between each timber, under the side walls and masonry in general -

When sheet piling may be necessary, the same to be done by the Contractor.

The length of piling to be regulated according to circumstances, the Contractor to estimate per one hundred feet superficial, - should bearing piling be considered necessary, the Contractor to state the rate per pile, each of which not less than 10 in. diameter is to be driven until a ram of 1200 lbs. weight falling from a height of fifteen feet will not drive the pile more than one inch at a stroke.

Masonry: - The side walls of these Locks to be 8 feet wide at bottom and five feet at top with a face batter of 3 feet, to be carried up perpendicularly in the rear to within 18 inches of level of coping -

Counterforts shall be 4 x 4 feet having five between the Piers or along the side walls.

Breast works to be as stated in general description 11-6, 10-6, & 10-3 respectively, on the breast work, the gates shall shut against the stone mitre cill, as shewn on centre lifts of plan - The Lower cill to be oak 15 x 18 inches to be constructed and foundation secured according to a working drawing to be furnished by the Engineer -

There is to be a back sill extending 4 feet under the walls of Lock, with a space between the sills for sheet piling, which shall extend across the whole breadth of the Lock under the masonry, with another range along the line and front of mitre sill, to be let into a rabbit taken out of the same; and the sheet piles fastened thereto with sufficient spikes; those piles to be of such lengths (not exceeding 10 feet) as may be considered necessary; across and between the stop gate groove a cill of not less than 18 x 16 of oak to be placed level with the mitre sill; and across the extremity of the wing walls 2 cills to be placed with a space between for piles and rabbited above to receive a 6 inch covering board to be spiked down; The space between the back cill and those cills to be properly filled flush with their top, with well dressed pitching on edge and fair jointed for their full depth, and grouted with hot lime or cement to the satisfaction of the Engineer or person superintending the works; -so as to effectually resist the dash of the water from the sluices, or at the Engineer's option the space to be laid of solid square timber, allowing the difference in either case -

The breast work arch to be constructed to a radius of

18 feet, the cill course to be 18 inches in depth to be got out in one length if possible but at least each alternte stone, & having the centre mitre Key stone in one -

The depth of masonry in breast work to be twelve feet at bottom longitudinally of Lock and stepped up by breaks to upper end of gate recess -

The ashlar to be properly cut with a marginal draft of 1-1/2 in: around each stone to be from 12 to 18 inch courses, to be jointed full 9 inches back, to be bedded full, back the whole depth, a header for every 2 stretchers not more than eight feet apart, stretchers to be from 3 to 5 feet lengths. No stretcher to be less in breadth of bed than twice the depth of course unless the course should run to 16 or 18 inches, in which case a course and a half will form the bed, no header to be less than 2 feet face & 4..6 deep from bottom to half the height of side walls, from these up 3..6 -

Side wall ashlar to be laid, square to the batter & to be bedded fully in water lime:-

The rubble or backing to consist of good fair bedded heavy stone, binding well in with the ashlar, to be set in mortar of proper proportions of sand and Lime as shall be decided by the Engineer, each course to be well grouted with Hot Lime grout before laying another.

The backing puddling of 18 inches in thickness to be brought up with the masonwork, so as not to leave more than 3 feet of wall at any time exposed longer than necessary.

For the particular situation of the Locks, reference may be had to the section upon which the respective depths of excavation are marked, subject to such deviation as may be deemed necessary-

Ashlar to be set with Shears or Lewis and no stone to be moved on the bed after set down, but to be raised and reset.

The sluices to be as commonly termed Land Tunnels around the upper and centre Breast works, to be 4 feet high and 2 feet wide of cut stone laid in cement, for which many of the smaller ashlar now delivered on the ground may answer, for the particular construction of the Tunnels working plans will be furnished by the Engineer -

The sluices will be near the face of these tunnels immediately behind the gates. For the reception of the frame work a Rabbit must be left 6 inches x 6 inches and an air hole carried up 12 inches square with an iron grating on top -

For the single Lock No. 1 (Dubuc's, now lock 8) to be rebuilt 24 feet wide on or near the present site, the foregoing specification for masonry is to be applicable and such of the Ashlar may be used as may work up to the Specification, but to be new jointed and new faced where necessary, the use of these materials must be taken into account in making up a tender for this work -

Should the foundation of timber be found sufficient the new work may be placed thereon.

For the combined Locks 20,000 feet of Ashlar more or less are on the spot and adjoining ground, as also a considerable quantity at Saint Johns, for these materials as well as for a large portion of backing stone prepared, it will be necessary that the Contractors state the prices they are willing to allow for such as may be found fit for the works -

Masonry to be paid for by the solid cubic contents without any allowance whatever -

The remainder of cut stone and ashlar to be had from Isle au Mott, Montreal, or Quarries of equal quality.

The coping to be 3 feet in breadth, and no hollow quoin stone to be less than 4..6 x 4 feet to be properly batted to the adjacent coping. In the event of inverted arches being

adopted the same to be from 1=6 to 2 feet depth of radiated bed, and from nine to twelve inch courses to be laid on well grouted rubble work, which shall be one foot in thickness at the Crown and carried level throughout the breadth of the lock foundation.

Embankments in all cases when practicable to be made with carts and not barrows, the soil to stripped off the surface and laid aside, and a check drain of 6 feet wide and 3 feet deep to be taken out of the natural ground to be well pounded in, with the clay composing the embankment and carried up to the top bank; the inside slope to be 2 feet to 1, outside from 2 to 3 and 4 feet to one as the case may be, to be soiled over 3 inches deep and sown with grass seed. The measurement of Embankment to be taken when completed and no allowance for shrinkage or subsidence.

It is to expressly understood that with a view to insure the completion of the work by the time hereinafter specified, that the lower lock shall be raised clear of low water by the fifteenth October next, after which date no masonry will be allowed to be proceeded with this season -

The cement to be subject to the approval of the Engineer or person superintending the works.

In the event of the Contractor not proceeding with the work to the satisfaction of the Engineer and using all due diligence in the prosecution thereof, it shall be in the power of the Commissioners through the Engineer to stop the work and prosecute the same in such manner as may be deemed advisable at the proper costs & charges of the Contractors and their securities, the Commissioners giving 10 days notice thereof-

Payments to be made monthly as the works progress in the proportion of ninety pounds to every hundred of work performed and returned by the Engineer, the balance to be paid on the fulfilment of the Contract.

Should any work not contemplated in the foregoing specifications be considered necessary or any alteration be required by the Engineer during the course of the work, a written order for the same must be given by the Engineer, and the value of the same solely determined by him, according to which a deduction or addition is to be made to the amount of the Contract as the case may be -

Two good and sufficient securities will be required for the due performance of the Contracts - The work to be fully completed by the 1st day of October 1841 -

(Signed.) N.H. Baird
Civil Engineer.

Chambly Canal Office
3rd July 1840

Specifications of works for the completion of the Chambly Canal, marked B, referred to in and as forming part of the annexed contract and agreement identified by the signatures of all the parties thereto and of us Notaries, at the time of the execution thereof this 11th day of August 1840.

(Signed.) William Lauder
" John Whitlaw
" William Tennant
" Dougald Stewart
" John Ross
" Wm Macrae
" Samuel Hatt
" Hamilton H. Killaly
" Eustache Saupras
" Thim Franchere

Thomas J. Patton N.P. H. Griffin N.P.

A true copy of the original minute remaining of record in my office -

(Signed.) H. Griffin
N.P.

Appendix F. Extract of Claims by Lauder, Whitlaw and Tennant for Locks, 1843[1]

24th June, 1843

Commissioners Chambly Canal

To Lauder Whitlaw & Tennant

1843

Feby To Sundries being the Amount of Engineers General Estimate of work performed &c.

Basin at Chambly viz			
" Excavation 4080 Cubic Yds at 3/2	644	-	-
" Building wharf 10213 Supl ft face Measure at 8d	340	8	8
" increasing width of do from 18 to 24 feet	59	11	9
" Covering wharf with 4 in plk 8280 ft at 4 3/4d	163	17	6
" Oak fenders No 69-- at 8/6 ea.	29	6	6
" Filling in wharf with clay 3709 C yds at 1/3	231	16	3
" Combined Locks viz			
" Excavation under water level			

4023 C y at 2/6	502	17	6
" do do do			
381 " at 1/6	28	11	6
" " above do			
16771 " at 1/	838	11	-
" Puddle trench rock Excavation			
153 " at 5/	38	5	"
" Puddling do with clay 185 1/2			
" at 1/6	13	18	3
" Sheeting piles hardwood 2600 ft			
at 100/per 100 ft	130	-	-
" longitudinal timber flattened 693			
ft at 62/6 per do	21	13	-
" transverse do sawed 2764			
" at 95/100 " "	131	19	7
" Chalking Joints -- 1664 ft			
at 95/100 " "	8	6	-
" Plank in bottom of Recess 1773 1/4			
ft at 5d	36	19	1
" Oak in Miter Sill & Stops 309 9/12			
Cubic ft at 5/	77	6	8
" Iron work in ditto 1014 lbs at 6d--	25	7	"
" pine sheeting piles 1594 ft at 4d	26	11	4
" Concrete in foundations 310- 23/27			
C. yds at 33/	512	8	3
" Masonry in Locks 8009 C. yds			
at 36/ 8-5/8 per yd	14704	"	5
" do in dwarf wall 357-10/17			
do at 20/ --	357	6	8
" do in Abutments of Bridge 70-11/27			
" at "	70	8	-
" Lead in Miter Sills 5075 lbs at 6d	126	17	6
" Slope wall west wing 38 C yds at 5/	9	10	
" Puddling round lock walls 1631 "			

at 1/	81	11	-
" Embanking locks 12403 locks 12403 " at 10d	516	15	10
" do road sides of Bridge 3769 " at "	157	"	10
" Excavation upper Basin 4726 C yds at 10 d	196	18	4
" Embankment above locks 23402 " " at 10 d	975	1	8
" Puddle trench 1473 " " at 1/	73	13	
" do do extra on Embt. 739 " " at 2d	6	3	2
" Mucking Embankment 420 " " at 3d	5	5	
" Removing old bank & Timbers 383 C yds at 1/6	28	14	
" Protection wall under No 5 lock 458 Supl " at "	34	7	
" Back Drain 572 " at 6d	9	7	

Lock No 1

Excavation 2032 Cubic yds at 1/	101	12	
Taking down old Lock 1230 Cubic " at 2/6	153	18	
Sheeting piles placed 182 Supl do at 4d	3	"	8
Flatted timber laid 736 ft at 62/6 per 100 ft	23	-	-
Oak in stop gate 59-1/6 Cube ft at 5/	14	15	10
do in Miter sill 70 " " at "	17	10	-
iron in ditto 67 lbs at 6d	1	13	6
planking lock bottom 3 inch 1273 Supl ft at 3 1/2 d	18	11	3
do do " 2 inch 1127 " " at 2 1/2 d	11	14	8

Masonry - - 1914-1/3 Cubic yds at 35/ 9-1/2	3425	17	2
Lead for ditto 1674 lbs at 6d -	41	17	
Embankment 3550 Cubic yds at 10 d	147	18	4

Appendix G. Materials for Rebuilding Portions of Locks 2, 3, 4 and 6, 1890-92[1]

[Rebuilding Walls of Locks 4 and 6 (old Locks 6 and 4) 1890]

Square pine, 2,019 1/8 cubic feet at 35c
Red pine, 1,124 5/12 do 55c
T. and G. pine 3,768 ft. B.M. at $20
Birch, 645 ft. B.M. at $35
Pea straw, 4,401 bundles at 4c
Hull cement, 225 brls. at $1.75, 80 at $1.85
Portland cement, White's, 25 brls. at $3.50
Sand, 251 brls. at 50c
Stone, toise, 4 at $7, 5 at $8, 8-1/4 at $9
Stone, toise of 216, 1 5/6 at $14
Board of masons, 238 days at 64c
Manilla rope, 623 lbs. at 17c, 111 at 18c
Iron, best refined, 866 lbs. at $2.75
Shovels, 24
Rent of ground for materials, $15, $10.
Freight
Superintendent, 4 trips to Montreal
do 4 do St. Johns
11 items under 4 each

[Rebuilding Lock 8, (old lock 2) 1891]

Stone, 100 c.y. at $5.50
  do 5 toise at $8
Sand, 1,266 brls at 30c
Cement, 1,000 brls. at $1.75
Freight on 1,000 brls. of cement
Square pine, 4,475.31 c. ft. at 37c
Wany pine, 2,499.77 c. ft. at 37c
Flat pine, 2,333.83 c. ft. at 21c
Square hemlock, 5,287.13 c. ft. at 20c
Round hemlock, 280 lin. ft. at 20c
Flat ash, 236.75 c. ft. at 21c
Pea straw, 3,076-1/2 bundles at 4c
Iron, lbs.: 11,362 at $2.75, 448 at $2.90
Steel, lbs.: 297 at 12-3/4c., 192 at 13c., 96 at 17c.
Washers, 597 lbs. at 8c.
Boiler plate, 1,630 lbs. at $3.10
Picks, 24, $21; 42 brooms, $3.50
Axes, 2 boxes at $10.50
Spikes, 215 lbs. at 8c
Files, 72, $27.90, nuts, 200 lbs., $16
Raw hide, 22 feet at 48c
Machine oil, 46 galls. at 70c
Wood, cords: 6 at $4, 11-1/4 at $3.50, 18-1/4 at $3.25
Slabs, 10 cords at $3
Sundry hardware
4 items under $6
Dr. J.S. Taupier, attendance from Dec. 4 to 23 on
L.H. Hebert, wounded in eye while working emery mill.

[Rebuilding Locks 4, 7, 8 (old lock 6, 3 and 2) 1982]

Arcand, Chas., gravel, 89-1/4 tons at 70c

Benoit, Arthur, board of P. Scott, 3 3/7 weeks

Benoit, Supt. P.B.

Trips to St. Johns, 8 at $3

do Montreal, 11

do electric station, 6

To Mile 8th, Ste. Thérèse road

Postage, $2.80; freight, $2.45

Bertrand, Damase, pea-straw, 481 boxes at 4c

Boivin, Alfred, pea-straw, 815 boxes at 4c

Boivin, Alfred, mixed wood 25 cords at $3.50

Boivin, Alphonse, mixed wood, 25 cords at $3.50

Boivin, Honoré, mixed wood, 25 cords at $3.50

Boivin, Honoré, manure, 4 loads

Brassard, Philias, hickory, 1 cord

Broullet, Norbert, pea-straw, 169 boxes at 4c

Bushnell Co., dynamo oil, 42.22 galls. at 45c

Chamberland, Ed., gravel, 33.81 tons at 65c

Chartres, Ed., stone, 3/4 toise

Coté, A.G., pea-straw, 813 boxes at 4c

Daigneault, Euclide, pea-straw, 2,287.8 boxes at 4c

Daigneau, Nap., pea-straw, 89 boxes at 4c

Deneau, Ephrem, pea-straw, 125 boxes at 4c

Desjardins, N., board of J. St. Pierre, 4 5/7 weeks

Desourdy, C., board of men, 18 2/7 weeks at $5

Fryer, Patrick, hickory, 1 card

Gervais et Frères, stone, 6 toise at $9

Goyette, Amable, jun., gravel, 30.885 tons at 65c

Goyette, Amable, sen., gravel, 51.471 tons at 65c

Goyette, Frs., gravel, 41.977 tons at 65c

Goyette, Jos., sen., gravel, 31.15 tons at 65c

Goyette, Ls., gravel, 35.733 tons at 65c

Huberdeau, Moise, pea-straw, 177 boxes at 4c

Jeuntôt, Aphter, mixed wood, 13-1/4 cords at $3.50
Jeuntôt, Arthur, stone, 5-1/2 toise at $8
Keegans-Milne Co., Montreal -
  Lamps, 50 c.p., 56 at $2.25
  Cases and packing
Lafrance, Wm., pea-straw, 132 boxes at 4c
Lamarre, Jacques, Chambly -
  Cutting coping stones, 125 sq. ft. at 30c
  Cutting hollow quoins, 47 sq. ft. at 40c
Lamarre, Ludger, Chambly -
  Cutting coping sones, 172 2/3 sq. ft. at 30c
  Board of C. Lamarre, 28 d. at 50c
Larocque, Ed., pea-straw, 6 cords at $3.50
Larocque, Jos., spruce, 6 cords at $3.50
Larocque, Tel., pea-straw, 205 boxes at 4c
Leveillé, Chas., sand, 700 casks at 30c
  do stone, 1 toise
Lussier, Norbert, pea-straw, 182 boxes at 4c
Maheu, Jos., pea-straw, 302 boxes at 4c
Marcil, Medard, pea-straw, 390 boxes at 4c; less sawing, $2.91
Meunier, S., stone, 2-3/4 toise at $8
  do wood, 13-1/2 cords at $2.75
Montreal Saw Works -
  Circular saw, 50-in.
  Repairing 2 saws
Monty, Jos., stone, 6 toise at $9
Moquin, Raphael, pea-straw, 274 boxes at 4c
Moreau, Nap., Chambly -
  Cutting coping stones, 115-1/2 sq. ft. at 30c
  Cutting hollow quoins, 52 5/9 sq. ft. at 40c
McNally, Wm., wood, 4 cords at $3
  do pea-straw, 120 bundles at 4c
McNally, W., & Co. Montreal -

White's Portland cement, 25 brls. at $2.65
Crown Portland cement, 75 brls. at $1.60
Freight from Montreal

Ostigny, Jos., Chambly -
Iron, 74.96 lbs. at $2.30
Iron, 10.889 lbs. at $2.40
Iron, A.F., 14.85 lbs at $3
Sheet iron, 26.35 lbs. at $3.15
Steel, 300-1/2 lbs. at 14c., 246 at 7c
Hydraulic cement, 100 brls. at $1.75
Freight on same from Quebec
Hemlock, 36,834 ft. at $11
Iron shovels, 24
Wooden shovels, 36
Nails, 3 kegs at $3.50
Spikes, 7x3/8, 3 kegs at $4.50
Ecroux, 400 lbs. at 7.3c., 200 at 8c
Files, 174
Washers, 969 lbs. at 5-3/4c, 425 at 6
Freight paid
Sundry hardware

Raymond, Moise, pea-straw, 682 boxes at 4c

Riendeau, H. Chambly -
Rope, 1,233 lbs. at 16c
Spruce, 306 l. ft. at 20c
Machine oil, xx, 47 galls. at 65c
Chestnut coal, 2.79 tons at $6
Chestnut coal, 2.79 tons at $6
Sundry hardware

Shortley, Geo., stone, 8 toise at $8

Terroux, Wilfrid, freight on 1.087 brls. of cement from St. Ours to Chambly

Tompkins, P., use of land at lock 4, to pile stone

Appendix H. Specifications for Partial Rebuilding of Locks 4 and 7, 1870[1]

Specifications for taking down and rebuilding portions of the Chamber and Recess walls at Locks 3 and 6 [now locks 7 and 4 respectively] Chambly Canal, 1870.

This work will embrace taking down and rebuilding about 150 feet of the defective portions of the walls in the above mentioned Locks and consist principally in rebuilding the center portions of the west chamber walls and upper recess walls to include the quoins and piers below the gates as may be directed by the Engineer or person in charge of the work.

As soon as the work has been awarded the contractor will be expected to provide at once all the necessary material for carrying on the work; and as soon as the water is shut out of the Canal, after the close of navigation, to commence taking down such portion of the walls, at each of these locks, as may then be decided on.

In removing the face stones from the old walls great care must be taken to preserve them as perfect as possible; and any stone that may be carelessly or unnecessarily broken, when being removed, must be replaced by a new cut stone, of the same dimensions by the Contractor and at his personal expense.

The Excavation will consist in moving the old walls, and from two to four feet of the Embankment in rear of the

wall, as may be directed, to form puddle trenches.

When removed, the faced stone and backing must be kept separate, and arranged so as to be convenient for rebuilding, and the refuse placed in rear of the bank or as may be directed.

The stones taken from the walls are to be used in rebuilding, and any others that may be required to make the work complete, must be furnished by the Contractor.

The walls will be rebuilt on the same plan as the present walls when new, but one foot thicker at the bottom. They will be relaid in Hydraulic Cement Mortar made of clean sharp sand and fresh ground cement, mixed as the Engineer may direct or consider necessary to make good-substantial water-tight work.

All the faced stone, whether new or old, must be of a sound and durable quality, free from seams or other defects, and laid in courses to correspond with those in the present walls; and neatly dressed, made square, bevelled or otherwise fitted to suit the position they are to occupy in the work. The arrises [?] must be kept good, the upper and lower beds made parallel for at least two thirds the depths of bed, and the end joints squared for at least nine inches back from the face, and form a mortar joint not to exceed $3/8^{ths}$ of an inch when laid.

The faced stone will consist of headers and stretchers of suitable length laid in line of the wall, and from two to three feet depth of bed in alternate courses. Any of the old faced stone not suitable for resetting will be rejected and used for backing, and replaced by new stone adapted and fitted to each course as at present arranged. All the new stone must be headers of at least two feet length of face and from three to four feet depth of bed, and placed not more than eight feet apart from centre to centre in line of wall. The headers in one course to be arranged, as nearly

as possible, midway between those of the courses above and below. No vertical points in different courses to approach each other nearer than twelve inches; and care taken that the bond in rear as well as face and at the junctions with the old walls is properly and satisfactorily arranged.

Any new hollow quoin stone that may be required will be dressed to correspond with those now in the work and be of such size as circumstances may require.

The old coping stone will be used, if found to be sound and suitable, if not, new stone for that purpose must be furnished by the Contractor.

The old backing must be properly selected and cleaned before being used in the new work. The old faced stone must also be cleaned of all old mortar and prepared for the places they are to occupy in rebuilding.

The walls to be carried up as uniformly as possible and the stones prepared to fit and fill their places before being brought on to the work; and all the vertical joints in one course properly grouted before another is commenced, and every precaution taken not to disturb the stones after they are placed, and to keep the walls free from all improper materials while the work is in progress.

The puddle or filling behind the wall, must be carried up with the wall and kept free from any objectionable matter or dirt from the walls, so as to form a perfect union with the old bank.

The work of rebuilding must commence as early in March as the weather will admit of and be carried on with such energy as to ensure its full completion on or before the 1st day of May 1871.

The Contractor must construct and maintain all coffer dams wherever it may be considered necessary or judicious to place them, in order to keep out the water either from the Canal or from surface drainage; the cost of all such dams

together with the expense of pumping or baleing, the removal of all ice or snow; and every contingency or expense connected with unwatering the work, from the commencement to its completion; and the satisfactory removal of all coffer dams or other temporary works, and leaving the work free for navigation must be embraced in the bulk sum tendered for unwatering the work.

The Contractor must provide his own service ground, as well as all tools, implements, machinery and labour, and to furnish all the materials necessary for executing and completing the work to the entire satisfaction of the Minister of Public Works, his Engineer, or person in charge of the work, on or before the 1st day of May 1871.

The following form will be observed by parties tendering. Canal Office, Montreal, 26 Sept. 1870.

Form of Tender

For Excavation, to include the old Lock walls, and the Earth removed in rear of them. Per Cubic Yard, $
For new faced Stone, to include Headers, Coping stone, Hollow or other quoins, dressed to fit the work, delivered. Per Cubic Yard $
For Backing stone, delivered, Per Cubic Yard $
For rebuilding Masonry, Per Cubic Yard $
For Puddle in rear of walls, Per Cubic Yard $
For unwatering work at Lock No. 3, removing of all snow and ice, forming and removing Coffer dams, pumping, baling, and in every respect keeping the work dry. -- The bulk sum of $
Ditto - Do at Lock No. 6. The bulk sum of $

Appendix I. Report by P. Panjwani on Excavations at Locks 6 and 7, 1974[1]

Field Trips by P. Panjwani, Restoration Services in February and March, 1974 to observe the excavations at locks 6 and 7.

27-8 February 1974
I visited Chambly Canal, Lock £6 and examined the excavations which were carried out on both banks of the lock.

On the east side the bank was excavated to a depth of 18 ft., and the stone masonry was observed to be continuing to an unknown depth. Behind the curb stones at the edge of the lock chamber, there is about 3'9" thickness of retaining wall with projecting counterforts. Two counterforts were exposed. The dimensions of these counterforts are approx. 3-1/2 ft. by 4 ft. The masonry for the wall and the counterforts is composed of dressed stones.

The west bank excavation was carried out to a depth of 14 ft. at one counterfort, and to a depth of 9 th. at two other counterforts, and again masonry was observed to be continuing to an unknown depth. A 4 ft. thick retaining wall with counterforts stands behind the curb stones. Three counterforts were exposed and they measure about 4 ft. by 4-1/2 ft. The composition of the masonry for the retaining wall and counterforts is of dressed stones.

The interior faces of the lock walls are battered

outwards, by some eight inches on the east bank and four to six inches on the west bank. The timbers are in good condition judging from their exterior appearance. The top portion of the masonry above the timbers is the only place where mortar joints have deteriorated badly and will require repointing.

In summary, the condition of the masonry for the retaining walls and counterforts is excellent and solid on both banks of the lock chamber. Except for local consolidation and resetting of face masonry no extensive repair work is necessary.

19-21 March 1974

Lock No. 6

Excavations were carried out to a depth of one foot to two feet on the east bank of the lock chamber. Four counterforts, two near the north end and two near the south end, were exposed. Beyond the gate at the south end, another counterfort of relatively large size, 5' x 8', was exposed. The stone masonry was in excellent condition.

On the west wall of the lock boreholes were drilled into the inner face of the chamber at 45° and 60° at various heights. At the base of the lock chamber timber protrudes six feet into the wall from the inner face. The spacing of these timbers is still unknown. However, when other boreholes are drilled, it might be possible to establish the spacing between the logs.

To determine the thickness of the timber wall, when one hole was drilled horizontally, it was found to be 28 inches wide. Thus, there is one more layer of logs behind the facing timbers of the wall.

The timber from the borehole samples appeared to be in good condition.

Lock No. 7

Excavations were conducted on the west bank of the lock chamber. A portion of concrete wall which was built in 1936-37 was exposed...

A second section of the stone wall was excavated, and behind the wall more counterforts were exposed. The stone masonry construction is similar to the Lock No. 6 wall but the counterforts are less than half the size of those at Lock No. 6.

At the south end beyond the gate, a counterfort measuring 1-1/2' x 7' was also exposed. This portion is built of stone masonry, although the curb is of concrete. Apparently this masonry was not removed when the concrete was poured.

Appendix J. Estimate for Repairs of Lock 3, 1858[1]

Work to be done Lock 7 (now 3)

1. Two Stones to fill the place of the 4...that are broken - extreme demensions 3-1/2 ft. x 6-1/2 ft. x 1-1/2...being about 65 cubic feet preparing, delivering and laying in cement....
2. Taking up and relaying 11 stones of arched coping.
3. Drilling 26 holes 57 inches deep 1-1/2 diam. and 56 holes 3 inches deep for dowels.
4. 10 barrels of cement
   100 bushels of sand.
5. Dowels for wedgeholds 1 3/8 in diam....

Upper breast of Lock 7

drilling holes
grouting - cement and sand
iron used in bottoms, coping

Estimate for repairing mitre sill of lock 7, Chambly Canal

Taking up and relaying 11 coping arch stones and cement
boring 20 holes 51 inches deep
cement and sand [illegible] grout these holes, and as mortar for bedding the stone - 10 barrels 100 bushels sand
repairing and relaying 2 coping arch stones 3-1/2 x 6-1/2 x 1-1/2 = 68 cu. ft.

26 fox wedge bolts 1 3/8" diam^{r} 51 inch.
28 dowels 6" x 1 3/8" diam.

Appendix K. Annual Maintenance on the Locks and Gates, 1895-96[1]

Les travaux des écluses sont tellement vaies et importants qu'il est difficile de les résumer en quelques lignes. Pour vous en donner une idée complète je crois devoir vous remettre de nouveau sous les yeux, le récit succint de ces divers travaux durant chaque mois de l'annee et tels que relatés sur le dos de la liste de paie de chaque mois.

July, 1895. Fitting gates at lock 9. Repairing sluice gate riggings at Lock 7. Putting rollers in rolling slides at the same. Putting fenders at lock 2; 45 sq. ft. pine, 26' tamarac (115 lbs rag-bolts 3/4 in). Repairing sluice frame gate at lock 5 and another one at lock 6. Emptying (Sunday, July 21st) levels from lock 2 to lock 9 for general review of locks. Putting 116 rollers in rolling slides of sluices at locks 2, 3, 4, 5 and 7. Putting an additional oak bar at upper lock gates No. 4. Putting fenders at lock 3 - 52 ft tamarac (14 lbs screw bolts 3/4 in.)

August -- Repairing two foot bridges for lower gates of lock 7. Sawing and putting two oak binders at lock gates No. 9 and 1 foot bridge at lock No. 2. - Taking out one old gate and replacing it by another one at lock 9. Preparing and putting a mitre-post for upper gates at lock 7.

Driving in ground a stop-post for balance beam at the same. Lifting out of water, 8 ft high east side of lock gate 9, in order to strengthen it by additional oak bars. Fastening back binder, 1 new rolling slide, new frame and rollers for the same.

September -- Putting 2 new gangways at upper gates of lock 3; ironing them (17 lbs flat iron 2 X 1/4 in) Repairing 2 cranks for lock 5 and one sluice at lock 8. Repairing gangways of lock 7 and ironing them (36 lbs sq. iron 1-1/2 in.) Repairing 12 large lanterns for locks and bridges.

October -- Making 4 new gangways for locks 1, 4 and 5, ironing them (65 lbs iron 2 X 3/8 in.) Ironing one spare sluice gate (55 lbs iron 4 X 1/2 in.) Repairing one post in lower gates of lock 3. Making iron ladders for lockgates 2 (165 lbs iron 4 X 1/2 in.)

November -- Putting a new sluice gate frame at upper gates of lock 3.

December -- Bracing locks 1 2 3 4 5 6 7 8 and 9 with sticks of timber for preventing frost to push lock walls inside. Taking apart one pair of old lock gates at lock 9. Making winter foot bridges at locks 2 3 4 and 5. Repairing one gate at lock 3, one new heel post, 2 bars and 2 balance beams.

January -- Making 5 balance beams. Preparing oak timber for one pair of gates for lock 9, 26' 6".0 high & two gates of 14'9" wide and one pair for lock 8 20' 4" 6" high x two gates of same width. Repairing 34 pairs of Ys and 8 prs of old squares for lockgates 6, 8 and 9. Making 12 prs of old Ys (432 lbs flat iron 3-1/2 x 1/2 in and 8 prs of new squares (288 lbs, 3-1/2 x 1/2 in) for same lock gates. Repairing 245 old screwbolts; making 150 new ones (375 lbs round iron 3/4 in for same.

February -- Sawing and planing timber. Working at lock gates 8 and 9. Ironing them (1073 lbs iron).

March -- Putting together lockgates 8 and 9. Ironing them. Making 8 new sluice gates and ironing them (Iron 3-1/2 X 1/2 in 1732 lbs 2 X 3/8 in, 38 lbs 4 X 1/2 in, 190 lbs; 3 X 1/4 in, 49 lbs; 2 X 1/2 in in 383 lbs, 1-1/2 X 3/8 in 26 lbs round iron 3/4 in, 87 lbs, 1-1/4 in, 88 lbs, 5/8 in, 11 lbs; square iron 1-1/4 in, 131 lbs). Framing and putting together one pair of gates 18' 4" high X two gates of 14' 10" for lock 6. Taking the two new prs of lockgates for locks 8 and 9 temporarily on the bank for storing them later on.

April -- Taking the new pr of gates at lock 6, and completing it (round iron 3/4 in, 653 lbs, flat iron 3 X 1/2 in, 569 lbs; 3 X 3/8 in 48 lbs). Placing it in position at the upper end of said lock. Repairing lower gates, one new sluice. Putting a new mitre sill at upper gates of lock 3. Painting lock gates of locks 1 2 3 4 5 6 7 8 & 9. Readjusting one pair of spare gates 18' 4" X two gates of

14'10" prepared last year, painted and stored.

May. Unbracing locks. Taking out of lock 6 one pair of old gates. Repairing 2 gangways at same lock.

June -- Repairing one sluice gate at lower end of lock 7.

Appendix L. Requisitions for Tools, Chambly Canal, 1862 and 1864[1]

Lachine Canal Office
Montreal 12th February 1862

Sir

Enclosed I beg to forward a Requisition for Carpenters Tools &c for the Services of the Chambly Canal.

These tools are required for the use of the Lock & Bridge Tenders who are employed on the repairs of mechanical structures during the winter season. A portion of them are carpenters and useful men. They have a pair of Lower Gates for Lock No. 8 nearly finished. The work is well done and will compare favorably with any work of the kind.

I am Sir
Your Obedient Servant

John G. Sippell
Supt. Eng.

T. Trudeau, Esq.
Secy. Public Works
Quebec.

Requisition

Required for the Service of the Chambly Canal the following Articles

6	3 quarters Screw Augers
6	3 quarters Gauges
2	5 quarters Screw Augers
2	6 " " "
4	8 " " "
1	Grooving Plaine
6	2 Inches Chissels
2	3-1/2 " Slice
6	Common Jack Plaines
6	" Smooling
1/2	Doz. hand saws
1/2	" Axes
1	Barrel 6 Inches Small Size Spicks

Chambly 9 February 1862

P.J. Chartier Supt CC.

John G. Sippell
Supt. Eng.

Lachine Canal Office
Montreal 30th January 1864

Sir,

Enclosed I beg to forward a Requisition for tools &c for the use of the Lock & Bridge Keepers on the Chambly Canal.

These men are employed in repairing and rebuilding the Locks Gates, Bridges &c during the winter season. There are several very good mechanics and handymen among them who deserve encouragement and it will repay the Department to furnish such tools for their use as the work requires.

I am Sir
Your Obedient Servt

John G. Sippell,
Supt. Eng.

T. Trudeau, Esq.
Secretary Public Works
Quebec.

Requisition

Required for the service of the Chambly Canal the following articles Viz.

1/2 Doz. Axes
2 Hand Axes
3 Jack Plains
1 Jointer
2 Drawing Knives
1 -2 Inch Rabit plain
Chisels 2 (1-1/2) 2 (1) 2 (3/4) 2 (1/2)
Gouges 1 (1-1/2) 1 (1) Inch
2 - 2 Foot squares
2 Try
1 Bavel
1 Oil Stove
1 Grindstone
1 Brace & Bits
2 Adds
2 Hammers, Augers 2 (2) 2 (1-1/2) 2 (1-1/4) 2 (1) 2 (1/2) 6 (3/4) Inc
2 Chalk lines & spools
1 Tape line 3 - 2 Foot Rules
1/2 doz. Carpenter Led Pensels
1 Framing Saw
1 Doz. Cross Cut saw files
1 Dozs. Hand saw files
1 Screw Driver
1 Gross 2-1/2 Inch Screws
56 lbs Red Paint
112 lbs. White led
10 galls Paint Oil
3 Locks for office
1 Padlock
1 Banch Saws (Wood)

C. Prefontaine
Supt. Chambly Canal

John G. Sippell
Supt. Eng.

Endnotes

Introduction

1 Lower Canada. Legislative Assembly, Journals of the House of Assembly of Lower Canada (v.p.: v.p., 1792-1841) (hereafter cited as Lower Canada, Journals of the Assembly), Vol. 40, 1831, App. H; Canada. Public Archives (hereafter cited as PAC), RG4, A1, Vol. S-268, p. 141, Hatt to Glegg, 18 July 1831; ibid., Vol. S-272, p. 46, Soupras to Craig, 5 Dec. 1831. Before the establishment of the Board of Works in 1839 it had long been the custom in Lower Canada to set up local boards of private citizens to administer the construction of each individual public work, be it a bridge, court house, road or canal.

2 £50,000 by 3 Geo. 4, cap. 41 and £10,000 by 4 Wm. 4, cap. 11.

3 PAC, RG4, A1, Vol. S-232, pt. 1, pp. 31-31h, "Report for a Proposed Canal between St. Johns and Chambly, both in the River Richeleiu [sic] in L. Canada," Feb. 1830.

4 Ibid., pt. 2, p. 94, Melhuish to Kempt, March 1830.

5 Ibid., Vol. S-250, pt. 1, p. 150, commissioners to Glegg, 29 Oct. 1830; Canada. (Province). Legislative Assembly, Journals of the Legislative Assembly of the Province of Canada (v.p.: v.p., 1841-67) (hereafter cited as Canada, Journals of the Assembly), Vol. 8, 1849, App. B.

6 PAC, RG4, A1, Vol. S-273, p. 11, commissioners to Aylmer, Dec. 1831; PAC, RG1, E15A, Vol. 260, "Account with Wm. Hopkins, 31 October 1831"; ibid., 11 Nov. 1833. Although the first lands were acquired in Sept. 1831, most of the purchases did not take place until early the next year. Many of the claims for compensation were not settled, in fact, until the land survey of 1849-50. See PAC, RG43, CI, Vol. 70.

7 Lower Canada, Journals of the Assembly, Vol. 42, pt. 2, 1832-33, App. Y; PAC, RG4, A1, Vol. S-293, pt. 2, p. 139, commissioners to Aylmer, 14 Nov. 1832.

8 Lower Canada, Journals of the Assembly, Vol. 43, 1834, App. K, "Report of the Commissioners of the Chambly Canal," 15 Nov. 1833.

9 PAC, RG4, A1, Vol. S-309, pp. 61-61c, report of J.B. Jervis, enclosed in commissioners to Craig, 9 Aug. 1833.

10 Lower Canada, Journals of the Assembly, Vol. 44, 1835, App. O. The wing walls and piers must not all have been completed, however, since in 1839 George Keefer recommended that they be given the same batter as the chambers. See PAC, RG11, Series II, Vol. 391, Keefer to Hatt, 24 Aug. 1839.

11 Legislation authorizing the enlargement of the locks had passed the provincial legislature in July 1833, but had been reserved by Lord Aylmer. Royal assent was delayed while British military authorities debated whether the canal should be proceeded with at all; assent was finally given in the autumn of 1834. The contractors signed the contract in July 1834, actually before royal assent had been given.

12 PAC, RG4, A1, Vol. S-331, pt. 1, p. 18, Ogden to Craig, 1 Dec. 1834.

13 Ibid., Vol. S-317, pp. 1-2, commissioners to Aylmer,

16 Jan. 1834.

14 Ibid., Vol. S-346, p. 412, petition of S. and S.R. Andres to Gosford, 26 Oct. 1835.

15 Lower Canada, Journals of the Assembly, Vol. 45, pt. 1, 1835-36, App. N. Some excavation seems to have been done at Chambly. A watercolour by P.N. Bainbrigge, dated 1838, shows a large hole with some timber framework at the bottom situated near the basin. See PAC, Picture Division, Paintings, Drawings and Prints Section, Neg. C-11856.

16 PAC, RG4, C2, Vol. 39, p. 15, provincial secretary to the commissioners, 18 April 1836; ibid., p. 204, the same to the same, 18 Oct. 1836. During 1836 the government reluctantly provided the commissioners with £1,500 on condition that the money be used for stabilization work and not for the payment of old debts.

17 PAC, RG11, Series II, Vol. 391, Keefer to Hatt, 5 Aug. 1839; ibid., 24 Aug. 1839.

18 Ibid., Vol. 378, file 37, contract with Lauder, Whitlaw and Tennant, 11 Aug. 1840, App. B.

19 Ibid.; PAC, RG12, Vol. 462, file 4250-6, "Assistant Engineer's Report, 1840."

20 PAC, RG11, Series II, Vol. 249, No. 14658, McDonald to Begly, 6 Aug. 1851.

21 Canada, Journals of the Assembly, Vol. 8, 1849, App. BB.

22 PAC, RG11, Series II, Vol. 249, No. 14658, McDonald to Begly, 6 Aug. 1851.

23 Canada, Journals of the Assembly, Vol. 13, 1854-55, App. O.

24 Ibid., Vol. 15, 1856, App. 31.

25 Canada. Department of Indian and Northern Affairs (hereafter cited as INA), Quebec Canals Office,

Montreal (hereafter cited as QCO), letterbooks, 1858-59, p. 390, Sippell to Secretary of Public Works, 14 Oct. 1859; ibid., 1859-60, p. 292, the same to the same, 5 Jan. 1860.

26 Canada. (Province). Legislative Assembly, Sessional Papers (Ottawa: Queen's Printer, 1863) (hereafter cited as Canada [Province], Sessional Papers), 1862, No. 3.

27 Canada. Department of Public Works, General Report of Public Works for the Year Ending 30th June 1869 (Ottawa: Hunter Rose, 1870) (hereafter cited as Canada, DPW, General Report), p. 20.

28 Ibid., 1870, App. 3, p. 9 and 1873, App. 3, pp. 12-3.

29 PAC, RG11, Series III, Vol. 47, No. 8601, Sippell to Trudeau, 13 Nov. 1869.

30 A federal act was passed during the parliamentary session of 1870 authorizing the incorporation of a company to build a canal between Lake St. Louis and Lake Champlain. Before such a company could be incorporated, however, the Dominion government established a canal commission to make recommendations for a long-range and coherent policy of canal building for the country. In its report, tabled in 1871, the commission recommended an enlarged Chambly Canal, with locks measuring 200 by 45 feet and with 9 feet of water on the mitre sills, the same size as the St. Ours lock further downstream.

31 Canada. Department of Railways and Canals, Report of the Minister of Railways and Canals (Ottawa: Hunter, Rose, 1870) (hereafter cited as Canada, DRC, Annual Report), 1880, App. 9, p. 139.

32 Canada, INA, QCO, letterbooks, 1880-81, Parent to Secretary of Public Works, 20 Nov. 1880.

33 The best of the masonry saved in the dismantlement was

used again. What new stone was needed was obtained from Isle La Motte in Lake Champlain.

34 For details of the reconstruction on a lock-by-lock basis, see the chapters on individual locks in this report.

35 Canada, DRC, Annual Report, 1894, App. 6, p. 143; ibid., 1897, App. 2, p. 130; ibid., 1899, App. 4, p. 200.

36 Canada. Parliament. House of Commons, Sessional Papers (Ottawa: Queen's Printer, 1867-) (hereafter cited as Canada, Sessional Papers), 1899, No. 10, p. 132.

37 Ibid., 1902, No. 20, p. 224; ibid., 1907, No. 20, p. 160.

38 Ibid., 1913, No. 20, p. 231; ibid., 1914, No. 20, p. 283; ibid., 1916, No. 20, p. 309.

39 Ibid., 1918, No. 20, p. 65.

40 Ibid., 1924, No. 32, p. 149; Canada, Sessional Papers, annual departmental reports, 1924-25, Vol. 7, p. 99.

41 Canada, DRC, Annual Report, 1933-34, p. 75; ibid., 1935-36, p. 82.

Lock 1

1 PAC, RG11, Series II, Vol. 378, file 37, contract with Lauder, Whitlaw and Tennant, 11 Aug. 1840, App. B. Written specifications had also been drawn up previously (by George Keefer in 1839) but they were modified and expanded by Baird the following year before tenders were called for.

2 Ibid., Lauder, Whitlaw and Co. to the commissioners, 19 Oct. 1840.

3 Ibid., Vol. 391, Keefer to Killaly, 30 July 1841.

4 Ibid., the same to the same, 18 Dec. 1841.

5 Ibid., and ibid., Vol. 378, file 37, Keefer to Hatt, 28 Sept. 1841.

6 Ibid., Keefer to Hatt, 28 April 1842.

7 Ibid., Keefer to Killaly, 19 Nov. 1842; ibid., 26 Nov. 1842.

8 Ibid., "Engineer's Calculations...," No. 4, 1843; Canada, DPW, General Report, 1867, p. 30; Canada, Sessional Papers, annual departmental reports, 1938-39, Vol. 4, p. 105.

9 PAC, RG11, Series II, Vol. 391, "Estimate of Work performed and Materials furnished on the Chambly Canal...," 1841; ibid., Vol. 378, File 37, deposition, 23 Feb. 1848.

10 Canada, Journals of the Assembly, Vol. 8, 1849, App. BB; PAC, RG11, Series II, Vol. 377, No. 7173, Borne to Begly, 27 Oct. 1848.

11 Canada, Sessional Papers, 1876, No. 6, p. 13.

12 Ibid., 1879, No. 7, pp. 18-9.

13 Ibid., 1881, No. 5, p. 139; Canada, INA, QCO, letterbooks, 1880-81, p. 463.

14 Canada, Sessional Papers, 1882, No. 8, p. 101; Canada, INA, QCO, letterbooks, 1880-81, pp. 473-5, Parent to secretary of DRC, 20 Nov. 1880; PAC, Picture Division, National Historic Photographs Collection, Neg. 85832, "Chambly Canal, Lockman's House."

15 Canada, Sessional Papers, 1884, No. 10, p. 86.

16 Canada, INA, QCO, letterbooks, 1880-81, pp. 473-5, Parent to secretary of DRC, 20 Nov. 1880.

17 Canada, Sessional Papers, 1887, No. 13, pp. 101-3.

18 Ibid., 1893, No. 9, pp. 104-5.

19 Canada, INA, QCO, miscellaneous records, "Superintendent's Report," 16 Aug. 1894.

20 Canada, Sessional Papers, 1898, No. 10, pp. 130-1.

21 Ibid., 1900, No. 10, p. 200.

22 Canada, INA, QCO, miscellaneous records, "Superintendent's Report," 1902, enclosed in Benoit to

Schreiber, 14 July 1902.

23 Canada, Sessional Papers, annual departmental reports, 1925-26, Vol. 4, p. 105.

24 Ibid., 1936-37, Vol. 4, p. 63.

25 Canada. Department of Transport (hereafter cited as Canada, DOT), Annual Report of the Department of Transport (hereafter cited as Annual Report), 1953-54, p. 42.

Lock 2

1 PAC, RG11, Series II, Vol. 378, file 37, contract with Lauder, Whitlaw and Tennant, 11 Aug. 1840, specifications, App. B.

2 Ibid., Vol. 391, Keefer to Killaly, 18 Dec. 1841.

3 Ibid., Keefer to Hatt, 1 June 1842; ibid., Keefer to Macrae, 31 Aug. 1842; ibid., Keefer to Killaly, 26 Nov. 1842.

4 Canada, INA, QCO, miscellaneous reports, superintendent's report, 5 Nov. 1891. The masonry in the coping and the breast wall was held in place with bolts leaded into holes drilled in the masonry. See PAC, RG11, Series II, Vol. 391, "Estimate of completing the Chambly Canal...," 4 May 1842.

5 See App. B, above.

6 PAC, RG11, Series II, Vol. 378, file 37, "Engineer's Calculations of Masonry...No. 4."

7 Canada, DPW, General Report, 1867, p. 30.

8 Canada, Journals of the Assembly, 1849, App. E; PAC, RG11, Series II, Vol. 377, No. 7141, Borne to Begly, 27 Oct. 1848.

9 Ibid., Vol. 391, "Estimate for the Chambly Canal, 1858." I assume that it is the upper mitre sill, since this sill is situated inside the lock, while the lower

sill rests within Lock 1, although the point is not made clear.

10 Canada, DPW, General Report, 1868, p. 335.

11 Canada, INA, QCO, letterbooks, 1878-80, pp. 613-5, Sippell to Braun, 5 Aug. 1879.

12 Canada, Sessional Papers, 1898, No. 10, p. 130; ibid., 1884, No. 10, p. 86; ibid., 1892, No. 9, pp. 102-3.

13 Canada, INA, QCO, miscellaneous records, superintendent's report, 5 Nov. 1891.

14 Canada, Sessional Papers, 1898, No. 10, p. 130.

15 Ibid., 1899, No. 10, p. 132.

16 Ibid., 1916, No. 20, pp. 308-9; Canada, DRC, Annual Report, 1930-31, p. 73; Canada, DOT, Annual Report, 1948, p. 20; ibid., 1954, p. 42.

Lock 3

1 PAC, RG11, Series II, Vol. 378, file 37, contract with Lauder, Whitlaw and Tennant, 11 Aug. 1840, specifications, App. B.

2 The original plans drawn up for the combined locks by Mr. Hopkins had called for the installation of paddle gates in the lock gates, but Keefer had opposed this system in 1839 on the grounds that such gates were often difficult to work, and that keeping the required machinery in repair would be a problem.

3 PAC, RG11, Series II, Vol. 42, No. 233; PAC, RG12, Vol. 462, file 4250-6, assistant engineer's report, 25 Nov. 1840.

4 Ibid., Vol. 391, Keefer to Board of Works, 30 July 1842; ibid., the same to the same, 31 Aug. 1842.

5 Canada, DPW, General Report, 1867, p. 130.

6 Excavations made between 24 May and 24 June 1842 (probably for the lockpit of lock 3 and the basin

above) indicate that of the total 20,000 yards removed, only 153 were rock.

7 Canada, Journals of the Assembly, 1849, App. E; PAC, RG11, Series II, Vol. 377, No. 7143, Borne to Begly, 27 Oct. 1848.

8 Ibid., Vol. 391, "Estimates for the Chambly Canal....", 1858. See App. G, above, for details.

9 Canada, (Province), Sessional Papers, 1865, No. 5; ibid., 1866, No. 1, p. 13; Canada, DPW, General Report, 1867, p. 30.

10 Canada, Sessional Papers, 1871, No. 4, pp. 8-9.

11 Ibid., 1884, No. 10, p. 86.

12 Ibid., 1886, No. 13, pp. 101-2.

13 Ibid., 1887, No. 13, p. 101.

14 Canada, INA, QCO, miscellaneous records, superintendent's report, 5 Nov. 1891.

15 A detailed report of the work was submitted to Ottawa by the superintendent of the canal: "Le Coté Ouest de l'écluse No. 8 [lock 2] comprenant l'enclave, la culée, la 'culvert sluice,' et la chambre plus la partie extérieure de massif contenant l'escalier emmuraillé, y compris le dit escalier, ainsi que l'enclave, la culée, la 'culvert sluice' et la chambre Ouest de l'écluse No. 7 [lock 3] et la chambre du côté Est de la dernière écluse ont été démolis sur une longeur totale de 380 pieds, sur 17 pieds de hauteur, et 8 pieds de largeur jusqu'aux fondations, moins le mur de face du massif, reconstruit il y a une dizaine d'années partie en bois partie en pierre....Les deux 'culvert sluices' ont été démolies complètement et la pierre de couverture de l'acqueduct brisée en plusieurs endroits a été remplacée par une forte couverture en épinette rouge ainsi que la partie supérieure du puits en pierre de taille. La 'culvert sluice' au haut de l'écluse No. 7

[lock 3] qui perdait beaucoup d'eau a été reparée jointoyée et puddlée." See ibid., 14 Nov. 1892.

16 Canada, Sessional Papers, 1916, No. 20, p. 309.

17 PAC, Picture Division, National Historic Photograph Section, No. PA-85801.

18 Canada, Sessional Papers, Annual departmental reports, 1925-26, Vol. 4, p. 105.

19 Ibid., 1930-31, Vol. 6, p. 73.

20 Canada, DOT, Annual Report, 1940-41, p. 48.

Lock 4

1 PAC, RG11, Series II, Vol. 337, p. 210, Bryson to Brown, 7 Jan. 1879.

2 PAC, RG12, Vol. 462, file 4260-6, Barret to Begly, 2 Oct. 1846; PAC, RG11, Series II, Vol. 377, No. 10650, Borne to Begly, 14 June 1850; ibid., Vol. 391, estimate of repairs, 1844; Canada, INA, QCO, letterbooks, 1856-58, p. 94, Sippell to Begly, 13 April 1857.

3 PAC, RG11, Series II, Vol. 391, estimate of repairs, 1844; Canada, INA, QCO, miscellaneous records, "Final Estimate of work done and materials furnished in the Taking down and Rebuilding portions of the Chamber and Recess Walls of Locks 3 and 6, Chambly Canal by F.B. McNamee, Contractor, 27 June 1871."

4 Canada, Journals of the Assembly, 1849, App. BB; PAC, RG11, Series II, Vol. 377, No. 7143, Borne to Begly, 27 Oct. 1848; ibid., Vol. 249, No. 14658, McDonald to Begly, 6 Aug. 1851. The latter document gives a detailed description of putting the coping on the lock walls.

5 Ibid., No. 10650, Borne to Begly, 14 June 1850.

6 Canada, INA, QCO, letterbooks, 1856-58, p. 93, Sippell to Begley, 13 April 1857; ibid., p. 233, annual report

for 1857 enclosed in the same to the same, 19 Jan. 1858; Canada, Journals of the Assembly, Vol. 17, 1859, App. 8.

7 Canada, Sessional Papers, 1866, No. 1, p. 13.

8 Canada, INA, QCO, miscellaneous records, "Final Estimate...1871." This is a very detailed statement, including tables and diagrams, of McNamee's claims for work performed. Technical problems have prevented its reproduction in this report, but the original is on file in the Quebec Canal Office, Montreal. Research Division of National Historic Parks and Sites Branch has copies on file in Ottawa.

9 Canada, DPW, Annual Report, 1872, App. 3, p. 9.

10 Canada, Sessional Papers, 1883, No. 8, p. 86; ibid., 1885, No. 11, p. 93; ibid., 1886, No. 13, p. 102.

11 Ibid., 1889, No. 10, p. 107.

12 Ibid.

13 PAC, Picture Division, National Historic Photographs Collection, No. PA-85613.

14 Ibid., No. C-60756; ibid., C-60757. J.E. Doré had drawn up a plan for the reconstruction done in the 1880s, although the limited amount of detail curtails its usefulness.

15 Canada, Sessional Papers, 1902, No. 20, p. 224; ibid., 1903, No. 20, p. 154.

16 Ibid., 1913, No. 20, p. 231.

17 Canada, Sessional Papers, annual departmental reports, 1925, Vol. 7, p. 98.

18 Canada, DOT, Annual Report, 1932-33, p. 79; ibid. 1933-34, p. 75; ibid., 1935-36, p. 82.

Lock 5

1 Canada, INA, QCO, letterbooks, 1856-58, Sippell to

Begly, 13 April 1873; Canada, DPW, General Report, 1867, p. 30; Canada, DRC, Annual Report, 1893, App. 9, p. 148; PAC, RG11, Series II, Vol. 249, No. 14658, McDonald to Begly, 6 Aug. 1851.

2 PAC, RG12, Vol. 462, file 4260-6, Barrett to Begly, 2 Oct. 1846; PAC, RG11, Series II, Vol. 377, No. 10650, Borne to Begly, 14 June 1850; Canada, INA, QCO, letterbooks, 1853, estimate, 1 April 1852; Canada, DPW, General Report, 1867, p. 30.

3 Canada, Journals of the Assembly, 1848, App. E; PAC, RG11, Series II, Vol. 377, No. 10650, Borne to Begly, 14 Jan. 1850.

4 Ibid.

5 PAC, RG11, Series II, Vol. 249, No. 14658, McDonald to Begly, 6 Aug. 1851.

6 Canada, INA, QCO, letterbooks, 1852, estimates, 1 April 1852.

7 Ibid., 1852-54, "Report on the Repairs necessary for the Chambly Canal...," 20 Jan. 1853.

8 Ibid., 1855-56, report on Quebec canals, 1856.

9 Ibid., 1855-57, Sippell to Cartier, 26 March 1857; ibid., 1856-58, p. 93, Sippell to Begly, 13 April 1857.

10 Canada, Sessional Papers, 1871, No. 4, pp. 8-9; PAC, RG11, Series III, Vol. 47, No. 8601, Sippell to Trudeau, 13 Nov. 1869.

11 Canada, Sessional Papers, 1874, No. 2, pp. 12-3; ibid., 1875, No. 7, p. 12; ibid., 1881, No. 5, unpaginated, "Annual Report of the Minister of Railways and Canals...," 1879-80.

12 Ibid., 1886, No. 13, pp. 101-2.

13 Canada, DRC, Annual Report, 1893, App. 9, p. 148.

14 Canada, Sessional Papers, 1910, No. 20, p. 230.

15 Ibid., annual departmental reports, 1926, Vol. 4, p. 105.

16 Canada, DRC, Annual Report, 1931-32, p. 87.

17 Canada, DOT, Annual Report, 1953-54, p. 42; ibid., 1954-55, p. 56.

Lock 6

1 Canada, INA, Restoration Services, "Report on the Restoration of Lock No. 6, Chambly Canal...," by Paul Stumes, 22 April 1974; Canada, DPW, General Report, 1867, p. 30.

2 PAC, RG12, Vol. 462, file 4250-6, Barrett to Begly, 2 Oct. 1846; Canada, Journals of the Assembly, 1849, App. BB.

3 Ibid.

4 PAC, RG11, Series II, Vol. 377, No. 10650, Borne to Begly, 14 Jan. 1850.

5 Canada, INA, QCO, letterbook, 1852-54, "Report on the Repairs necessary for the Chambly Canal...," 20 Jan. 1853.

6 Ibid., 1859-60, p. 278, annual report for 1859, enclosed in Sippell to secretary, DPW, 24 Dec. 1850; ibid., p. 292, the same to the same, 6 Jan. 1860.

7 Canada, Sessional Papers, 1873, No. 6, p. 9; ibid., 1875, No. 7, p. 12.

8 Ibid., 1879, No. 7, p. 18; ibid., 1881, No. 5, p. 139; ibid., 1882, No. 8, p. 101.

9 Ibid., 1883, No. 8, pp. 85-6; ibid., 1886, No. 13, p. 102.

10 Ibid., 1889, No. 10, pp. 106-7; ibid., 1890, No. 19, p. 101.

11 Canada, INA, QCO, miscellaneous records, "Superintendent's Report, 1892."

12 Ibid., 16 Aug. 1894.

13 Canada, INA, Restoration Services Division, File

131-9-001/9, report prepared by P. Panjwani, 27-8 Feb. 1974; ibid., 19-21 March 1974. Photographs of the uncovered portions of the lock are on file in Restoration Services Division and in Research Division, National Historic Parks and Sites Branch, Ottawa.

14 Canada, Sessional Papers, 1902, No. 20, p. 224; ibid., 1903, No. 20, p. 224; ibid., 1914, No. 20, p. 284.

15 Ibid., 1918, No. 20, p. 65.

16 Canada, DRC, Annual Report, 1931-32, p. 87.

17 Ibid., 1935-36, p. 82; Canada, DOT, Annual Report, 1941-42, p. 19.

18 Canada, INA, Restoration Services, file 131-9-001/0, report by P. Panjwani, 27-8 Feb. 1974.

Lock 7

1 PAC, RG12, Vol. 462, file 4250-6, Barrett to Begly, 2 Oct. 1846; PAC, RG11, Series II, Vol. 377, No. 10650, Borne to Begly, 14 Jan. 1850; Canada, DPW, General Report, 1867, p. 30; Canada, INA, QCO, miscellaneous records, "Final Estimate of work done...by F.B. McNamee...27 June 1871"; Canada, INA, Restoration Services Division, file 131-9-001/0, report by P. Panjwani, 19-21 March 1974.

2 Canada, Journals of the Assembly, Vol. 8, 1849, App. BB.

3 PAC, RG11, Series II, Vol. 377, No. 7014, Borne to Begly, 12 Oct. 1848; ibid., No. 10650, the same to the same, 14 Jan. 1850.

4 Ibid., Vol. 249, No. 14658, McDonald to Begly, 6 Aug. 1851.

5 Canada, INA, QCO, letterbooks, 1855-56, report, 1855; ibid., 1855; ibid., 1856-58, Sippell to Begly, 8 Jan. 1857.

6 Canada, Journals of the Assembly, 1857, App. 29; ibid., 1859, App. 8.

7 Canada, DPW, General Report, 1867, p. 30.

8 PAC, RG11, Series III, Vol. 47, pp. 337-42, "Specifications for taking down and rebuilding portions of the Chamber and Recess Walls at Locks Nos. 3 and 6 [locks 4 and 7] Chambly Canal."

9 Canada, INA, QCO, miscellaneous records, "Final Estimate of work...done by F.B. McNamee...27 June 1871."

10 Canada, Sessional Papers, 1873, No. 6, p. 9.

11 Ibid., 1875, No. 7, p. 12; ibid., 1882, No. 8, p. 101.

12 Ibid., 1883, No. 8, p. 85; ibid., 1889, No. 9, p. 104.

13 Canada, INA, QCO, miscellaneous records, superintendent's report, 16 Aug. 1894.

14 Canada, Sessional Papers, 1889, No. 9, p. 104.

15 Ibid., 1903, No. 20, p. 156; ibid., 1907, No. 20, p. 160; ibid., 1916, No. 20, p. 309.

16 Canada, DRC, Annual Report, 1930-31, p. 87; ibid., 1932-33, p. 79; 1933-34, p. 75.

17 Ibid., 1935-36, p. 82.

18 Canada, DOT, Annual Report, 1936-37, p. 63.

19 Ibid., 1945-46, p. 21; ibid., 1954-55, p. 56.

Lock 8

1 Until the mid-1840s it was known as Lock 1. The guard lock at St. Jean, which at first was not numbered but was simply called the "guard lock," then became known as lock 1; the old lock was called lock 2 thereafter until 1925.

2 Lower Canada, Journals of the Assembly, Vol. 43, 1833-34, App. K.

3 PAC, RG4, A1, Vol. S-346, p. 412, statement of extra

work done on the Chambly Canal, enclosed in petition of Samuel Andres Jr. and Stephen R. Andres to Lord Gosford, 26 Oct. 1835.

4 Ibid.

5 PAC, RG4, A1, Vol. 289, p. 75, Kuper to Craig, 8 Sept. 1832; Lower Canada, Journals of the Assembly, Vol. 43, 1833-34, App. K.

6 PAC, RG4, A1, Vol. S-309, pp. 61-61c, Jervis report, enclosed in commissioners to Craig, 9 Aug. 1833.

7 Ibid., Vol. S-377, pp. 83-4, contract, 7 July 1834; ibid., Vol. S-346, p. 412, statement of extra work, enclosed in the Andres' petition to Gosford, 26 Oct. 1835.

8 PAC, RG11, Series II, Vol. 391, Keefer to Macrea, 30 Sept. 1842.

9 Ibid., Vol. 378, File 37, "Engineer's Calculations of Masonry...No. 4."; ibid., Lauder, Whitlaw and Co. to commissioners, 24 April 1843; ibid., commissioners to Lauder, Whitlaw and Tennant, 24 June 1843.

10 Ibid., "Engineer's Calculations of Masonry...No. 4"; ibid., Vol. 377, No. 7014, Borne to Begly, 12 Oct. 1848.

11 Canada, DPW, General Report, 1867, p. 30.

12 PAC, RG11, Series II, Vol. 377, No. 7014, Borne to Begly, 12 Oct. 1848. The superintendent of the canal, Mr. Borne, said "puddled," not repuddled, although one doubts whether the canal would have been built without at least an attempt at puddling.

13 Ibid., Vol. 349, No. 14658, McDonald to Begly, 6 Aug. 1851.

14 Canada, INA, QCO, letterbooks, 1852-54, "Report on the Repairs necessary for the Chambly Canal, 20 Jan. 1853"; ibid., p. 216, Page to Begly, 14 April 1853.

15 Ibid., 1857-58, Sippell to commissioners of Public

Works, Jan. 1858; Canada, Journals of the Assembly, 1859, App. 8.

16 Canada, INA, QCO, letterbooks, 1858-59, Sippell to Sicotte, 9 Nov. 1858; Canada (Province), Sessional Papers, 1866, No. 1, p. 13.

17 Canada, Sessional Papers, 1875, No. 7, p. 12; ibid., 1880, No. 6, p. 20; ibid., 1881, No. 5, p. 139.

18 Ibid., 1883, No. 8, p. 85.

19 Ibid., 1885, No. 11, p. 94; ibid., 1896, No. 10, p. 140.

20 Ibid., 1915, No. 20, p. 312.

21 Ibid., 1909, No. 20, p. 149; ibid., 1914, No. 20, p. 283; ibid., 1915, No. 20, p. 312.

22 Ibid., annual departmental reports, 1924-25, Vol. 7, p. 99.

23 Canada, DOT, Annual Report, 1939-40, p. 49.

24 Ibid., 1966-67, p. 37.

Lock 9

1 Lower Canada, Journals of the Assembly, Vol. 44, 1835, App. O; PAC, RG11, Series II, Vol. 391, Keefer to Hatt, 24 Aug. 1839; Canada, DPW, General Report, 1867, p. 31.

2 PAC, RG11, Series II, Vol. 377, No. 7143, Borne to Begly, 27 Oct. 1848; ibid., Vol. 249, No. 14658, McDonald to Begly, 6 Aug. 1851. In the latter document, McDonald states that each bridge coping required "fifty-four fox wedge bolts of two feet six inches long, with nuts and screws, and connecting bars, cemented and leaded into holes drilled in the masonry to receive them." It is logical to assume that the lock coping was set in place in a similar fashion.

3 Canada (Province), Sessional Papers, 1862, No. 3, unpaginated, "Report of the Commissioner of Public

Works for 1861."

4 Canada, Sessional Papers, 1874, No. 2, p. 12; ibid., 1875, No. 7. p, 12; ibid., 1867, No. 6, p. 13; ibid., 1877, No. 6, p. 15; ibid., 1880, No. 6, p. 20.

5 Ibid., 1884, No. 10, p. 86; ibid., 1886, No. 13, p. 101.

6 Ibid., 1887, No. 13, p. 101; ibid., 1889, No. 9, p. 107.

7 Ibid., 1901, No. 20, p. 191.

8 Ibid., 1924, No. 32, p. 149.

9 Canada, DRC, Annual Report, 1933-34, p. 75; ibid., 1934-35, p. 83.

10 Ibid., 1935-36, p. 82; ibid., 1939-40, p. 49.

Gates and Gate Mechanisms

1 Quebec. St. Hyacinthe, Palais de Justice, Pronotary's Office, P.E. Leclere files, contract for the construction of the Chambly Canal, 5 Sept. 1831.

2 PAC, RG4, A1, Vol. S-327, pp. 83-4, contract for the enlargement of the locks, 1834.

3 Ibid., Vol. S-346, p. 412, "Statement of Extra Work done on the Chambly Canal by Samuel Andres Junior and Stephen Reddington Andres, Contractors, to the 1st day of October 1835." See App. D, above.

4 Ibid., Vol. S-309, pp. 61-61c, report of J.B. Jervis enclosed in commissioners to Craig, 9 Aug. 1833.

5 Ibid., Vol. S-346, p. 412, statement of extra work.

6 PAC, RG11, Series II, Vol. 391, Keefer to Hatt, 24 Aug. 1839. Keefer added that a rack and pinion would be preferable to the lever, but would be more expensive.

7 Ibid., Baird to commissioners, 11 Aug. 1840.

8 Ibid., Keefer to Hatt, 5 April 1841.

9 Ibid., the same to the same, 27 May 1841.

10 Ibid., Vol. 378, file 39, Keefer to Hatt, 1 Sept. 1841; ibid., Vol. 391, Keefer to Killaly, 18 Dec. 1841.

11 Ibid.; and ibid., Keefer to Macrea, 31 Aug. 1842.

12 Ibid., Vol. 378, general estimate of works to 1 Jan. 1843.

13 Ibid., Vol. 36, register of letters, 1843-46.

14 PAC, RG12, Vol. 462, file 4250-6, Barrett to Begly, 20 Oct. 1846.

15 PAC, RG11, Series II, Vol. 377, Borne to Begly, 26 Nov. 1847; ibid., the same to the same, 4 Feb. 1848.

16 Canada, Journals of the Assembly, 1849, App. BB.

17 PAC, RG11, Series II, Vol. 377, inventory, 26b Feb. 1852.

18 PAC, RG12, Vol. 462, file 4250-6, Barrett to Begly, 29 April 1847; PAC, RG11, Series II, Vol. 377, Borne to Begly, 28 April 1847.

19 Canada, Journals of the Assembly, 1851, App. T; PAC, RG11, Series II, Vol. 249, No. 16254, McDonald to Begly, 2 April 1852.

20 PAC, RG43, C1, Vol. 9, p. 91, contract with David and J.L. Wilkinson, 27 Sept. 1841.

21 PAC, RG11, Series II, Vol. 391, "Calculations of the Cost of Gates for a Stone Lock...," 17 Aug. 1839.

22 Ibid., Vol. 377, Borne to Begly, 9 April 1843.

23 Ibid., Vol. 391, Keefer to commissioners, 30 July 1842; ibid., Vol. 378, "General Estimate of Work to 1 January 1843."

24 Ibid., Vol. 249, No. 14658, McDonald to Begly, 6 Aug. 1851.

25 Chaffey was also awarded the contracts for the gates of the St. Lawrence Canals that year. The price for the Chambly Canal gates was £345 per pair. See Canada, INA, QCO, letterbooks, 1852, Legge to Begly, 29 June 1852.

26 PAC, RG11, Series II, Vol. 249, No. 16870, McDonald to Begly, 9 June 1852.

27 Canada, INA, QCO, letterbooks, 1852, Page to Chaffey, 18 Dec. 1852. A requisition in 1878 called for oak timbers for lock gates -- 14 pieces of 10- by 12-inch pieces for the transverses, 2 pieces 16 by 13 inches by 18-1/2 feet for the quoin posts, one piece 11 x 13 inches by 18-1/2 feet for a mitre post, and 2 pieces 12 by 16 inches by 14-1/2 feet for a bottom bar. Until the 1890s the timbers were hand-hewn, not sawed.

28 Canada, DPW, General Report, 1867, p. 30.

29 Canada, Sessional Papers, 1888, No. 9, unpaginated, "Annual Report of the Minister of Railways and Canals...from the 1st July, 1887 to the 30th June 1887, on the works under his control." In the 6 years between 1886 and 1892, 7-1/2 pairs of old gates were replaced. See ibid., 1893, No. 9, unpaginated, annual report of the Minister of Railways and Canals for 1891-92.

30 Ibid.

31 Canada, INA, QCO, miscellaneous records, superintendent's report, 4 Nov. 1892. After 1888 the hardware for the canal was made at the canal forge, located at the Chambly workshops. The work was done by the lockmasters and labourers over the winter.

32 Ibid., 19 July 1896.

33 Ibid.

34 Canada, Sessional Papers, 1901, No. 20, p. 193.

35 Canada, INA, QCO, letterbooks, 1870-74, Sippell to Page, 4 March 1873.

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38 Ibid., 1912-13, p. 731, Marceau to Bowden, 31 Jan.

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40 Canada. Auditor-General's Office, Report of the Auditor-General (hereafter cited as Canada, AGO, Annual Report), 1913, Vol. 3, p. W-85; Canada, INA, QCO, letterbooks, 1912-13, p. 744, Marceau to Bowden, 4 Feb. 1913; ibid., Marceau to Lavoie, 1 March 1913.

41 PAC, RG11, Series II, Vol. 391, Keefer to Killaly, 26 Nov. 1843.

42 Ibid., Series III, vol. 47, p. 17, Sippell to Trudeau, 13 March 1861.

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44 PAC, Picture Division, National Historic Photograph Collection Neg. PA-85626.

45 PAC, RG11, Series II, Vol. 391, "Calculation of the Cost of Gates...," 17 Aug. 1839.

46 Ibid., "Estimated Repairs, required to be done on the Chambly Canal, 1844"; PAC, RG43, C1, Vol. 9, contract with David and J.L. Wilkinson, 1841.

47 Canada, Sessional Papers, 1892, No. 9, p. 102.

Appendix A

1 PAC, RG4, A1, Vol. S-232, pt. 1, pp. 31-31h.

Appendix B

1 Quebec, St. Hyacinthe. Palais de Justice. Pronotary's Office, P.E. Leclere files.

Appendix C

1 PAC, RG4, A1, Vol. S-327, pp. 76-84.

Appendix D

1 PAC, RG4, A1, Vol. S-346, p. 412.

Appendix E

1 PAC, RG43, Series C, Vol. 10.

Appendix F

1 PAC, RG11, Series II, Vol. 378.

Appendix G

1 Canada, AGO, Annual Report, 1889-90, p. D-145; ibid., 1890-91, pp. C-94-5; ibid., 1891-92, pp. C-107-8.

Appendix H

1 PAC, RG11, Series III, Vol. 47, pp. 337-42.

Appendix I

1 Canada, INA, Restoration Services Division, file 131-9-001/0, field trip reports, reports by P. Panjwani, 27-8 Feb. and 19-21 March 1974.

Appendix J

1 PAC, RG11, Series II, Vol. 391.

Appendix K

1 Canada, INA, QCO, miscellaneous records, superintendent's report, 16 July 1896.

Appendix L

1 PAC, RG11, Series II, Vol. 47, No. 57453; ibid., No. 68149.

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