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A 17th Century Sluice Raises New Questions at Grand-Pré

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A 17th Century Sluice Raises New Questions at Grand-Pré

Jonathan Fowler

On 19 May, 2006, a machinery operator named Larry Cranton made a surprising discovery while excavating a drainage ditch on the Grand-Pré Marsh (Figure 1). While carving a trough through the marsh mud, the steel bucket at the end of his excavator's great hydraulic arm met with a momentary resistance, tugged, and then snapped up a broken segment of an old wooden sluice. Two other logs likewise sprang up. Suspecting the find might be significant, Robert Palmeter, a local farmer who had stopped by the work site a short time later, contacted Wayne Kelley, Parks Canada Assets Officer at nearby Grand-Pré National Historic Site. Within minutes, my phone was ringing, and we were all scrambling to make way for the arrival of an unexpected visitor from the past. What was this object? How old was it? Who put it there and why?

These and other questions preoccupied an animated group of researchers for the warmer months of 2006. Following preliminary research activities associated with the recovery of the remaining portions of the sluice, and close on the heels of the restored object's installation as part of the permanent exhibit at Grand-Pré National Historic Site, the time has come to introduce this find to a scholarly readership. The following cannot represent the final words on this intriguing artifact. Research is ongoing, and our knowledge of this sluice will no doubt shift as our understanding of the marsh's natural and cultural history continues to evolve. Nevertheless, its unannounced arrival has already brought us a great deal of new information.

The logistics of discovery

The recovered portion of the sluice was transported to Grand-Pré National Historic Site of Canada by Wayne Kelley and his staff on 19 May, 2006. On 26 May, Colleen Day, Senior Conservator, and Amanda Thomas, Conservator, both of Parks Canada, visited the site and examined the sluice. They determined that the wood was heavily waterlogged, and that despite appearances of solidity, the object was in a vulnerable state: in fact, the water within the wood was providing much of the structural support. The



FIGURE 1: Site location map. The black star indicates the location of the site.

SOURCE: National Topographic Series 21H/1, Wolfville (2000).

implications were clear: if the sluice were to be allowed to dry, it would quickly begin to crack, warp, and disintegrate. For this reason, following its transportation to the national historic site, the recovered items were placed in a jury rigged pool. Here they would remain stable while deliberations about its future could proceed.

In the meantime, cleaning with a pressure sprayer (Figure 2a)¹ offered the first good look at the sluice, revealing it to be a single hollowed out log, still bearing the tool marks of its makers (Figure 2b). The wooden clapet was still in good working order (Figure 2c), but owing to its delicate (and highly portable) nature, it was removed to the Parks Canada Conservation Lab in Dartmouth where it would be treated separately.

1. The water tank contained a pump connected to a network of perforated rubber hoses to ensure an even distribution of water over the exposed portions of the sluice. Any mud adhering to the wood risked clogging the hoses or pump, and therefore had to be removed in advance.

The discovery of the sluice created something of a sensation, and raised some immediate — and potentially quite challenging — questions. For instance, the find spot itself, being near the very center of the Grand-Pré Marsh, was more than a little unexpected for two reasons. The first was that this central location is thought to be one of the earliest to have been dyked

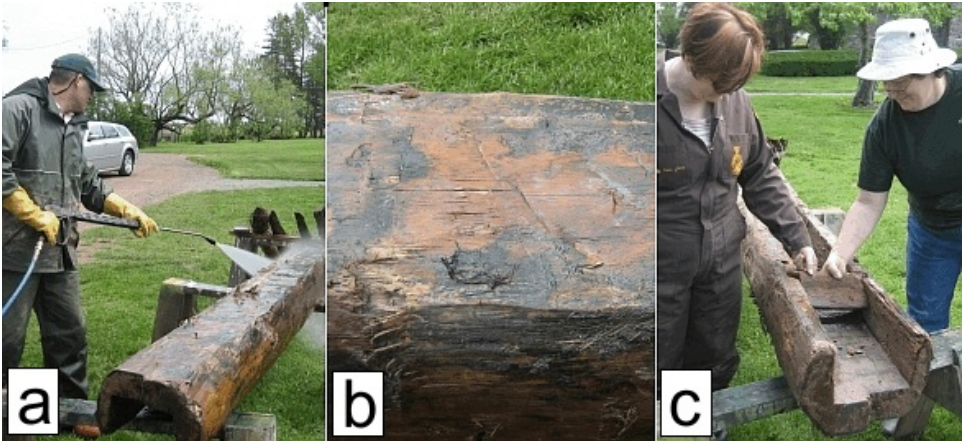


FIGURE 2: The initial cleaning of the sluice. (a) Stephen Coldwell, of Parks Canada's Grand-Pré staff, cleans the mud from the underside of the sluice with a pressure sprayer. The end of the sluice closest to the camera is the finished end through which the water exited the sluice when it was working. (b) Tool marks still visible on the flattened underside of the sluice. (c) Amanda Thomas (left) and Colleen Day (right) display the intact clapet. Photos courtesy of Victor Tétrault.

by the Acadians. A sluice in this location would therefore have to be very old, and consequently it would be a minor miracle if it had survived undisturbed for so long. Perhaps it might have been installed later, as part of a repair job undertaken by the New England Planters who farmed these lands after 1760? The second reason was that there are no known dyke walls in this part of the marsh, which is very strange. A brief digression may clarify the significance of this point.

Our present knowledge of the cultural history of the Grand-Pré Marsh derives largely from Dr. Sherman Bleakney's recent work, in which he proposes a developmental model for understanding the Acadian dyking sequence (2004). Dr. Bleakney's model is based primarily on a study of the marsh's natural drainage system, which is a natural place for a marine biologist to start, over which he superimposes a map of the largely relict network of dyke walls. It also draws important information from interviews with some of the few remaining old dyke hands who had built and maintained the dykes before the arrival of heavy machinery. Bleakney's

work represents a significant improvement over the initial efforts to understand the Acadian dyking program at Grand-Pré undertaken by Cameron (1958), who focused on plotting the dyke network as revealed by aerial photography, but essentially ignored the underlying drainage patterns that allowed the system to function. Though Cameron gave us many of the bones, Bleakney stitched them up in the flesh of folklore, and charted the workings of its hydraulic circulatory system.

With the drainage creeks and dykes plotted, the sequence in which the enclosures were built may be determined by two apparently basic assumptions. First, in this patchwork quilt of dyked enclosures, the newer patches should connect either to older sections of dyke or to the upland. Second, since water flows downhill, and effective drainage was essential to the functioning of the entire system, the inhabitants must have constructed their various enclosures in a manner that did not impede this flow. Bleakney's resulting sequence of enclosures is shown below (Figure 3).

Figure 3 demonstrates the first significant problem presented by the accidental discovery. The new sluice comes from an area *within* Bleakney's third enclosure rather than along the line of the dyke wall. This is very peculiar given that an aboiteau is, by definition, a component — indeed a fundamental component — of a dyke system. It ought not to be disconnected from a dyke wall. A few additional words by way of historical context will not be out of place here.

The fundamentals of Acadian dyking technology are already well known (e.g. Bleakney 2004; Cormier 1990; LeBlanc and LeBlanc 1993, 624-626; Ross 2002), and much that has been published is based on a small number of primary sources. Prominent among these is the relation provided by Sieur de Dièreville, with which readers of these pages will likely be familiar, who visited Port Royal in 1699 and published an account of his voyage in 1708 (Gallant 1985; Webster 1933).² Having observed the distinct character of Acadian agriculture, Dièreville describes dyke construction as follows:

...five or six rows of large logs are driven whole into the ground at the point where the Tide enters the Marsh, & between each row, other logs

2. As a point of interest, Butzer's suggestion that reference to "24 boisseaux" at Port Royal in the 1671 census might indicate 24 operational "aboiteaux" may probably be disregarded (Butzer 2002, 467). The statement comes under the heading "recolte," and the "boisseau" is in fact a unit of dry measure. For additional discussion see Fowler, forthcoming.

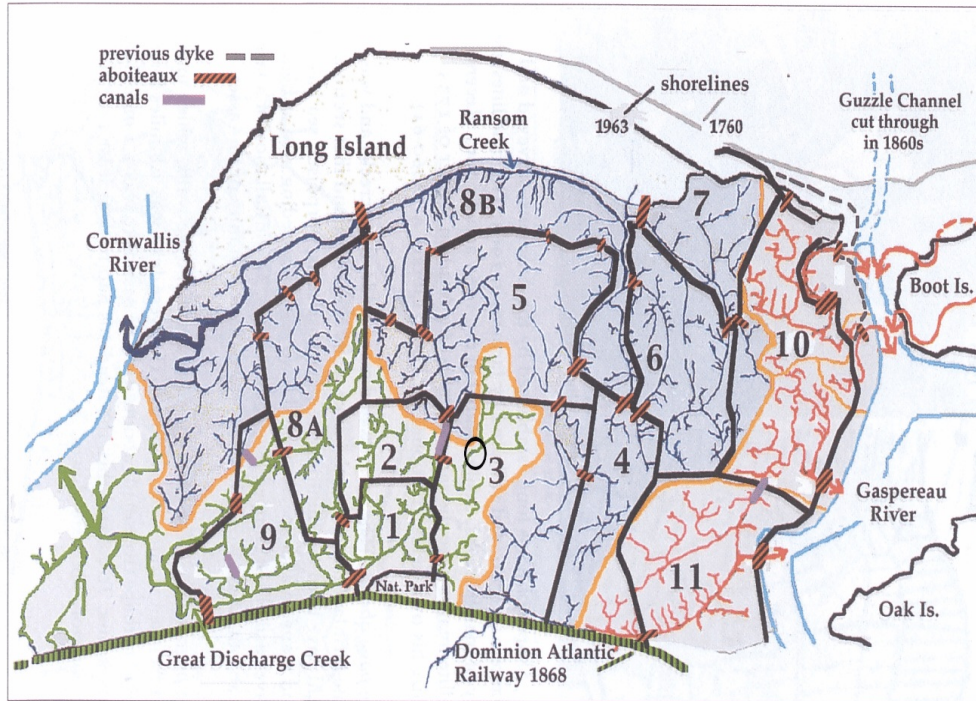


FIGURE 3: Bleakney's developmental model of the Acadian dyking sequence at Grand-Pré. The thick black lines depict Acadian dyke walls while the more sinuous, thinner lines indicate the creeks that form the marsh's natural drainage system. The numbers indicate the sequence in which Bleakney reasons each section of the marsh was dyked, and his predicted locations of aboiteaux and canals are likewise indicated. Our sluice was installed in the deeply curved creek just to the left of the top of the number 3 (circled). SOURCE: Bleakney 2004, p. xxiii.

are laid, one on top of the other, & all the spaces between them are so carefully filled with well-pounded clay, that the water can no longer get through. In the centre of this construction, a Sluice is contrived in such a manner that the water on the Marshes flows out of its own accord, while that of the Sea is prevented from coming in. An undertaking of this nature, which can only be carried on at certain Seasons when the Tides do not rise so high, costs a great deal, & takes many days, but the abundant crop that is harvested in the second year, after the soil has been washed by Rain water compensates, for all the expense. As these lands are owned by several Men, the work upon them is done in common; if they belonged to an Individual, he would have to pay the others, or give to the Men who had worked for him an equal number of days devoted to some other employment; that is the manner in which it is customary for them to adjust such matters among themselves (Webster 1933, 95).

This passage contains treats for the historical geographer as well as the social historian.

With respect to the architecture of the “Acadian aboiteau,” and indeed the definition of this term, we begin with its marshland context: it is situated within a creek bed (“where the Tide enters the Marsh”), supported by a significant structure composed at least partly of wood (“rows of logs”). Dièreville’s observations are confirmed by other eye-witnesses, most notably Jonathan Crane (1819), a New England Planter who was well accustomed to working on the dykelands at Grand-Pré, perpetuating the techniques introduced by the Acadians. He maintains that the stakes and logs driven in to the creek bed around the sluice were essential to reinforce the aboiteau against water pressure, which regularly pressed against it from both inside and out. To properly anchor the aboiteau, “pickets ought to be drove plentifully through it...” Neglecting this step was to invite catastrophe, for “I never saw an Aboiteau slip up or down a creek, except at the foundation” (Crane 1819).

According to Dièreville, the Acadians used the term “aboteaux” to refer to the dyke as well as the sluice, rather than just the sluice itself (1933, 94). While the term itself originated in France prior to the colonization of Acadia, its etymology and full range of meanings may not yet be fully charted (Hatvany 2002; cf. Dupont 1978, 304; Faragher 2005, 49).³ Interestingly, though, Crane follows Dièreville’s convention of identifying the aboiteau as the entire section of a dyke wall that crosses a creek and contains a sluice,

3. In one instance, it appears on a 1741 map of La Rochelle to signify the gates used to control water levels in the port (Hatvany 2002, 125).

which suggests some stability in the colonial use of the term. Presumably it is because this was (and remains) not only the key component of the dyking system, but also the most technologically sophisticated element, that he goes to some lengths to describe it. It also briefly depicted in this broad, “sluice-and-dam” sense, on a 1760 map of Horton Township, which indicates a breach in the dyke wall at the point where it crosses “Deportation Creek” (Bleakney 2004, 121). The breach is labelled “Broken Boit de Eau,” suggesting the entire structure had washed out rather than that the sluice itself had collapsed.⁴ It is worth noting that the map’s author is none other than Charles Morris, a man who was well acquainted with the Acadian agricultural system, having been in a position to observe it first hand.⁵

Despite these historical usages of the term, it has become almost conventional today to refer to the sluice component as an aboiteau (e.g. Faragher 2005, 49; Jobb 2005, 45), which is fair enough, so long as we recognize the ambiguity. One of the questions that confronted us in the summer of 2006 related to this very issue of nomenclature: was the mystery sluice just a sluice, or was it only one part of a complete aboiteau?

Sherman Bleakney’s model of the Acadian dyking sequence at Grand-Pré benefited from a surviving survey of the marsh drawn up in the 1760s by John Bishop (2004, 75).⁶ This large scale plan is probably the single most important source available for understanding the Acadian dyking system at Grand-Pré, for it plots not only the network of dyke walls as they existed in the early phase of New England Planter settlement, but also various roadways and field divisions, many of which likely date to the Acadian occupation. By reconsidering our site location in light of this map, with one eye still on Bleakney’s model, it becomes apparent that the find spot is situated at an intersection of structures that may be either roads or dykes, or some combination (Bleakney interprets them as roads), and more specifically at a point where one of these structures crosses a creek.⁷ Figure 4 displays an overlay of the historical map with a 1967 aerial photograph. The farm road under which our sluice was found remains in use to this day, although it shows up better in an aerial photograph from 1945 (Figure 5).

4. Nova Scotia Department of Resources Crown Lands Information Management Centre, Kings County Portfolio, map 4.

5. Charles Morris, n.d. [c. 1748] *Brief Survey of Nova Scotia...*, Library and Archives Canada, MG 18 F10.

6. The plan is labeled “Plan No. 2,” and may be found in the Kings County portfolio at the Nova Scotia Department of Resources Crown Lands Information Management Centre (map 5-18-A).

7. Unfortunately, the Bishop plan does not clearly distinguish roads from dykes.

This was essentially the state of our knowledge by the end of May, 2006. The recently discovered “aboiteau,” which appeared to be isolated from any of the known dyke walls in the area, was looking very much like some kind of culvert installed beneath a road. Yet it was undeniably a sluice with a one-way valve rather than an open drain. Its builders had therefore clearly intended water passing this way to move only in one direction: southward. Why? Further, the object appeared to have been installed in a part of the marsh that was, according to Bleakney’s model, enclosed fairly early in the Acadian occupation. The possibility therefore existed that this was a very old object, but how old? And more pressingly for the integrity of the model in this area, was this a simple culvert, or was it a true aboiteau, signalling the existence of a previously unidentified section of the dyke system?



FIGURE 4: Site location (centre of black circle) on compiled air photo and 1760s map. This plan is not registered, and is intended for illustration only. The plan overlay is approximately scaled and modified to 40% opacity. SOURCE: A19985-170, 1967.

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FIGURE 5: The roadway (white line) under which the sluice was discovered as seen from the air in 1945. The black arrow indicates the find location at the point where the road crosses the creek bed (the course of the creek is indicated by dashed lines). North at top. SOURCE: Sherman Bleakney (A8645-53, 1945). ©Department of Natural Resources Canada. All rights reserved.

The fundraising efforts of Victor Tétrault, Executive Director of the Société Promotion Grand-Pré, soon resulted in the financial means to support a salvage archaeology project to recover the remaining *in situ* portions of the sluice. The landowner, Donald Kennie, was amenable to the plan and agreed to allow access to the site for the duration of the project. Meetings between The Nova Scotia Museum, Parks Canada, and the Société Promotion Grand-Pré led to an arrangement whereby Parks Canada would contribute conservation services, and the province, in whose jurisdiction the object was discovered, would in effect permanently loan the object to a new exhibit at Grand-Pré National Historic Site. All that remained was the salvage archaeological work, for which my team was called in.

Methodology

In hindsight, our approach to this project represented something of a gamble. Expectations had been raised, funds had been solicited, and several organizations were dedicating resources to the task of rescuing an object of really unknown origin. What if, after all this effort, the “Acadian aboiteau” was discovered to date to the 19th century? Dendrochronology provided the best chance for a firm date, and with this goal in mind we contacted André Robichaud at the Mount Allison Dendrochronology (MAD) Lab. The MAD Lab specializes in using tree-rings to determine the ages of old samples of wood, such as those that might be sampled from an old house, or for that matter from a sluice. By measuring tiny differences between the widths of the growth rings in the sample, and by comparing the sample’s growth rings to a sequence of growth rings of a known age, the age of the sample may be determined.



FIGURE 6: André Robichaud of Mount Allison University’s Dendrochronology Lab extracting a tree ring sample from one of the posts.

What’s more, if the last growth ring on the sample is present, the actual year in which the wood was cut may be determined (Renfrew and Bahn 2008, 138-141). André visited Grand-Pré on 9 June, 2006, to take samples from the recovered portion of the sluice and the two associated posts (Figure 6). Before the tree ring dates could be determined, however, the field season was upon us. Armed with assurances derived from our understanding of landscape history, but not without concern, we moved ahead with the recovery process.

The initial plan was to mechanically excavate the earth covering the object, leaving a narrow perpendicular baulk for stratigraphic recording, and then to trace the extent of the sluice. Once it had been suitably recorded, the baulk would be removed by hand and the sluice lifted mechanically. In practice, we had to abandon the baulk because of the difficulty it posed for mechanical excavation. The close proximity of the site to a planted field, as well as to two drainage ditches, hemmed us in, and the additional labour required to undertake this work by hand would have significantly extended

our time in the field and exceeded our resources. Therefore, an alternative approach was taken: the extent of the feature was traced mechanically, and two profiles (the north and the west sides of the excavation trench) were cleaned for stratigraphic recording. Once the overall extent of the remaining elements of the sluice had been delineated using heavy equipment, we cleaned the structure by hand. Then, following recording, the sluice was lifted with the aid of the mechanical excavator, placed on a trailer, and taken back to Grand-Pré National Historic Site for stabilization in an enlarged water tank.

In practice, the extraction operation did not proceed as easily as our plans had anticipated. Having tentatively concluded that this was not an “aboiteau” (in the sense that it did not appear to be a major component of a dyke wall), we were prepared to encounter a structure of only limited architectural complexity. But once the soil was removed, we soon found ourselves facing more archaeology than we had expected.

Results

It is worthwhile considering the appearance of the *in situ* remains prior to excavation, for the excavator, in cutting his drainage trench across the marsh, had already encountered more than just our sluice here. As Figure 7 demonstrates, the cutting exposed a long history of hydrological engineering activities at this location. As far as we could determine, the oldest and deepest element of these works was the sluice itself (Figure 7, #1), the top of which was found at about 1m below the present surface. By tracing the grain of the wood through the clay, it was possible to observe that some of the planks covering the sluice also remained *in situ* (Figure 7, #1a), but in a very poor state of preservation. Just above the sluice, to the east, the broken end of a plastic pipe dribbled water (Figure 7, #2). The recent installation of this pipe must have come precariously close to the sluice, but appears to have not even grazed it.⁸ Curiously, adjacent to the sluice to the west, bedded slightly higher in the profile, additional wooden elements could be seen (Figure 7, #3). This was a cause of much speculation. Finally, a concrete pipe, another fairly recent installation, though probably not as recent as the plastic pipe, appeared to be bedded almost directly on top of these curious wooden elements (Figure 7, #4). The potentially problematic component of this crude cross section was the additional wooden elements (#3), which frankly puzzled us at the time.

8. It may, however, have damaged and/or carried away the plank covering in this location.



FIGURE 7: The rough cut side of the excavated drainage ditch, revealing its archaeology, as it appeared on 26 May, 2006, camera facing north. Here we may see: (1) the sluice, with its broken end exposed; (1a) elements of the poorly preserved plank cover of the sluice; (2) a modern plastic drain pipe; (3) portions of another wooden feature (identity unknown at the time of this visit); (4) a concrete drain pipe bedded on top of the mysterious wooden feature; and (5) Dr. Sherman Bleakney (for scale).

The salvage excavation commenced on 14 July. A backhoe removed the overburden and delineated the archaeological features (Figure 8) and the rest of the day was spent on detail work with hand tools.⁹ It soon became apparent that the mysterious wooden elements immediately west of the sluice were mirrored by another set above the sluice on the east side. Further detailed excavation on 15 July revealed this to be a series of poorly preserved spruce poles bedded horizontally just above, and parallel to, the sluice. The discovery of these poles, which had been laid out side-by-side, above and parallel to the line of the sluice, appeared to have been designed as a hardened surface over which one could travel. Might this have been the remains of a corduroy road (Figure 9)? (An additional set of labelled close-up images is presented as Figure 10). If so, it seems only to have extended the width of this narrow creek, and even within these tight confined portions seem to have been removed. For example, the poles immediately above the center line of the sluice were missing, the intervening space filled with a tangle of brush and wood debris.

9. I would like to thank our operator, Henry Biggs, for his expert assistance with the machinery. Guy Allen-Hermanson and Matt Cloutier assisted with the detail work.



FIGURE 8: Three photographs showing the progress of mechanical excavation (left to right) to determine the extent of the in situ sluice (camera facing north).



FIGURE 9: The cleaned sluce feature prior to the removal of the corduroy road remnants.



FIGURE 10: The sluice and corduroy features at the end of the initial phase of excavation; (top) with Robert Shears (camera facing north); (middle) with Sara Beanlands (camera facing southwest); (bottom) camera facing south.

Hand excavations provided an opportunity to more closely investigate the stratigraphic relationship between the various elements of this construction.¹⁰ Figure 11 provides a sketch of these elements. Plan views with the “corduroy surface” in place and removed are shown in Figure 12 and Figure 13 respectively.

The sluice itself was found to have been laid on a bed of marsh sods.¹¹ These sods filled the spaces between the sluice and the two *in situ* parallel logs, and were noted beneath these logs as well. The compressed marsh grass under the latter was still green in places, though most of this organic matter had turned black. Examination of the root structures preserved within these sods allows us to identify the species of salt marsh grass as *Spartina patens* (Bleakney 2004, 32).¹² Above the sluice and lateral support logs, additional sod blocks were placed, apparently with care, for the seams between the sods gave evidence of an alignment running perpendicular to the sluice, and the sods joined one another neatly, not unlike bricks in a well built wall. On top of this, the poles and brush had been laid horizontally.

There are two significant variations in this overall pattern that deserve note: one on the west side of the sluice and another directly above it. To the west of the sluice, and separated by three poles, a 20cm-wide plank was discovered at the same level. Abutting it, again to the west, a crude channel had been formed by a series of smaller planks, all badly degraded (see Figure 10, “second wooden drain”). Stratigraphically, this feature, which amounted to yet another water channel, was demonstrably more recent than the main sluice. It was located at the level of the poles (and higher), and the brushwork

10. I would like to thank Sara Beanlands, Matt Cloutier, Robert Shears, and Jeff Turner for their hard work on 15 July, during which time most of the sluice and its associated architecture was delimited by hand. Subsequent work was carried out with the assistance of Rob Ferguson and students from the Grand-Pré Archaeological Field School Project. Dr. Sherman Bleakney, who knows the marsh perhaps as well as anybody, provided invaluable support throughout the recovery project.

11. The full extent of this sod foundation was difficult to determine on account of the waterlogged condition of the ground at this depth. Marsh sods were evident between the sluice and the support logs, and we observed some additional sods immediately under the southern (i.e. broken) end of the sluice. The nature of the preserved organic material beneath the support logs and the sluice, evident once we had removed them, suggested a mixture of salt marsh grasses and mud. But again, owing to the water it was difficult to determine whether these marsh grasses were growing here prior to the installation of the sluice or whether they represented portions of marsh sods brought in from another location, though I suspect the latter was the case.

12. Sherman Bleakney, personal communication, 21 July, 2006.

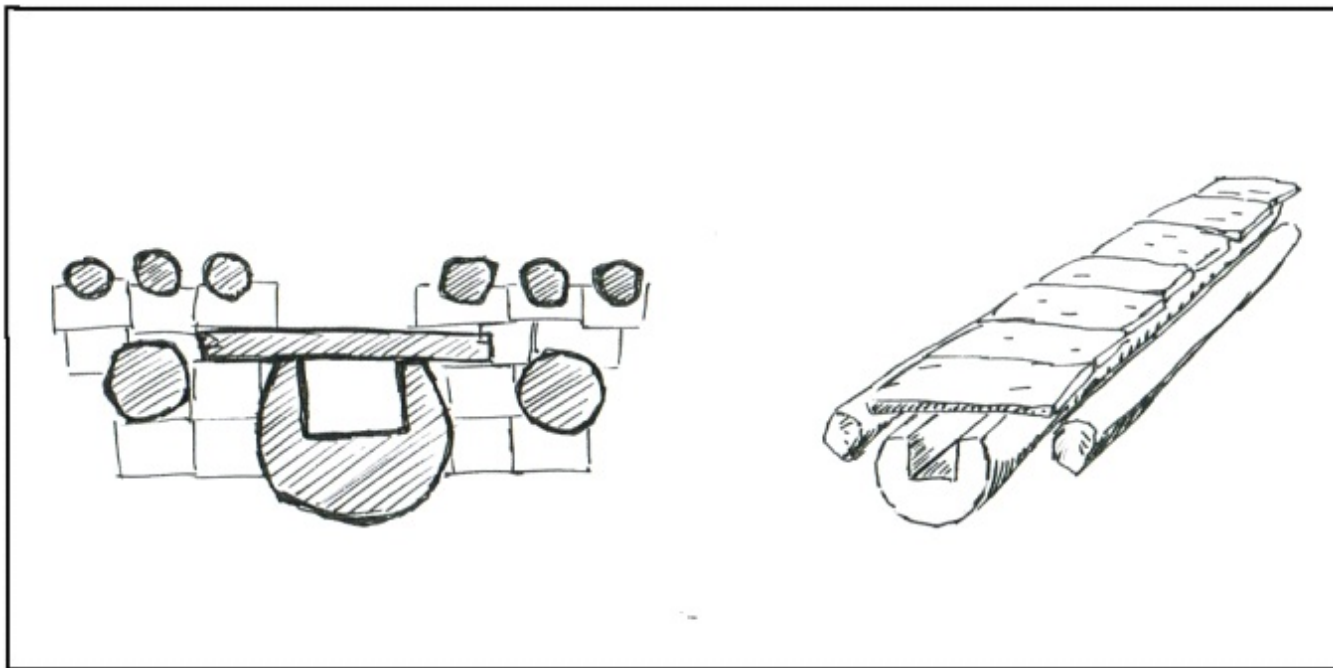


FIGURE 11: Sketch of the sluice and associated features. The views are from the south (l) and southeast (r), and are not drawn to scale. Material beneath the dashed line in the left-hand image was not excavated.

ran underneath it. This relationship was supported by the discovery of a single wire nail associated with the channel, which suggests it was installed no earlier than the 1860s or 1870s (Nelson 1968, 10). Traces of this structure ran the whole length of the sluice, but appear to have been badly damaged by the later installation of the concrete pipe (Figure 7, #4).

Directly above the sluice we found no “corduroy” poles. They had either never been installed or had been installed but later removed. In their place, a dense mat of spruce brush was encountered, with the spruce needles still reasonably well preserved. I can think of at least one good reason for this deviation to have occurred here, and it probably relates to an anomaly in the wood planking covering the sluice approximately 1.8m from its broken end. Here, a triangular hole had been cut into the planked surface of the sluice, apparently with an axe. The result is a small weeping drain that would have channelled water from the top of the structure directly down into the sluice channel.

Interpretation of the site’s stratigraphy was complicated by two factors: the land had been extensively shaped by modern agricultural activities, greatly altering its 17th-18th century character. Also, waterlogged conditions at the base of our excavation prevented us from probing deeply enough to ensure that we were seeing all of the cultural layers. In fact, practically all of the stratigraphy we observed was above the level of the sluice and associated features, and much of the upper 40-60cm of the profile was taken up with crushed rock from the modern road surface. Additional elements had been scoured away by construction activities associated with the installation of the concrete drain. With the lower levels beyond reach and the upper levels mangled beyond recognition, we were thus given precious little to interpret. Two vertical section drawings are shown here: Figure 14 (north) and Figure 15 (west). The challenging work environment does not appear to have unduly hindered the builders. Our measurements determined that the *in situ* portion of the sluice had a grade of only 3.5cm over its 4.2m length.¹³

13. This slope was probably not effected through direct measurement during installation. Rather, the builders likely set the sluice in place and then poured water into it to see how it carried.

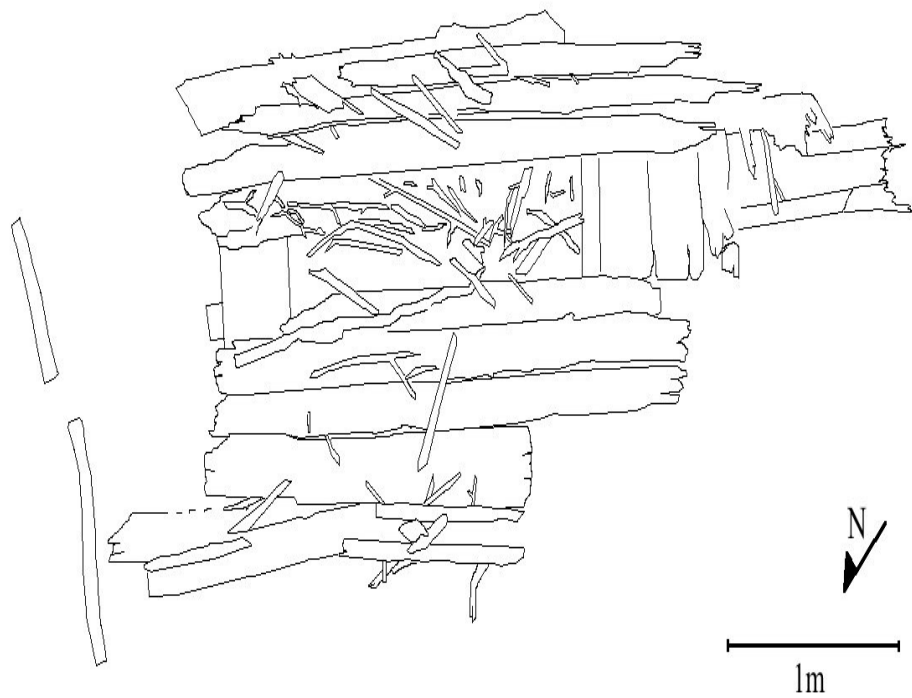


FIGURE 12: Plan view of the sluice with the corduroy surface still in place. Brushwork can be seen overlying the corduroy and in the gap in the corduroy surface directly above the sluice.

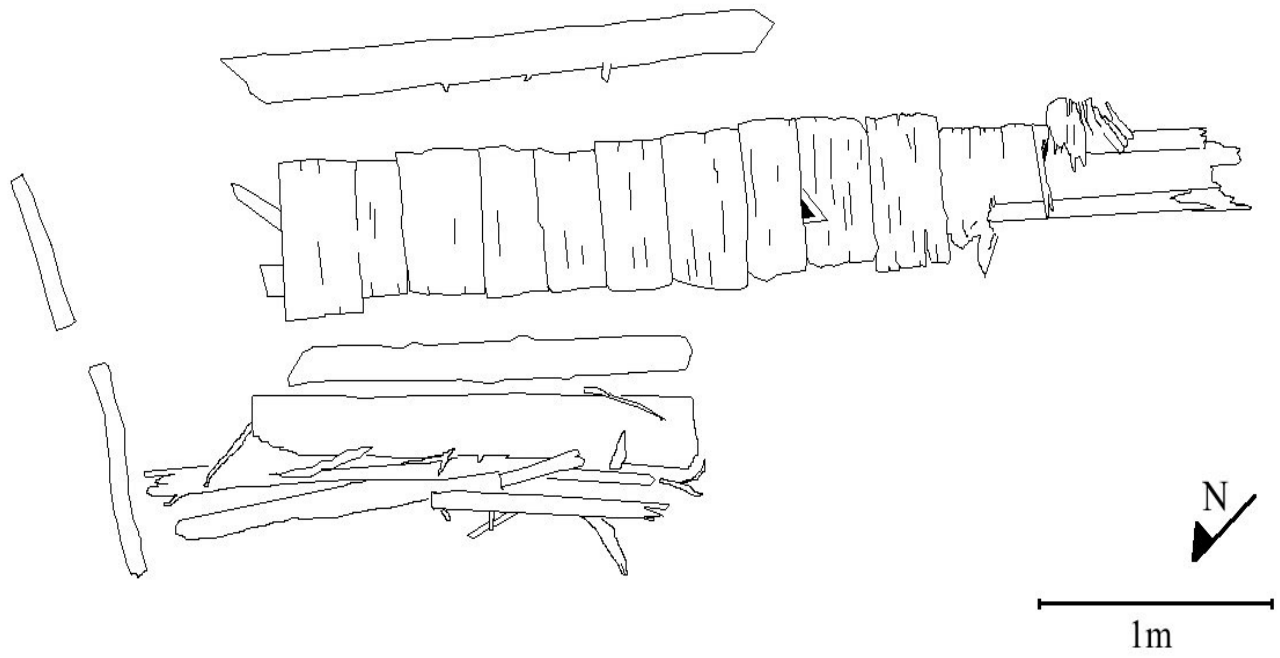


FIGURE 13: Plan view of the sluice with the corduroy surface removed. The cleaning process reveals the weeping drain cut into the planks covering the sluice (triangular feature, centre right).

It stands to reason that if the wooden elements picked up in the west profile (hatching, Figure 15) relate to the brushwork and/or “corduroy structure” overlaying the sluice, then the layers immediately beneath (#s 5 and possibly 6) represent either natural marsh development beside the creek at the time of installation, or fill material placed within it during installation. As these are essentially homogeneous sediments, they are probably natural.

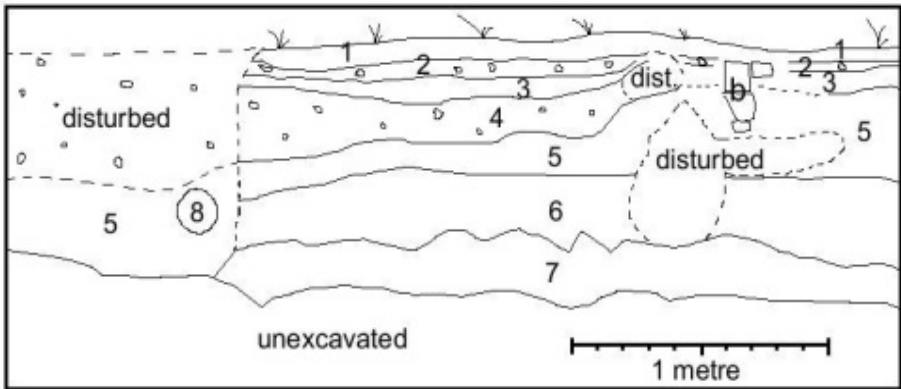


FIGURE 14: North profile: (1) sod; (2) crushed rock; (3) brown clay; (4) crushed rock; (5) red clay; (6) grey clay; (7) red clay; (8) concrete pipe. Sod bricks are labelled “b”. Disturbed areas represent portions of the profile that collapsed during machine excavation, and the construction trench for the concrete pipe.

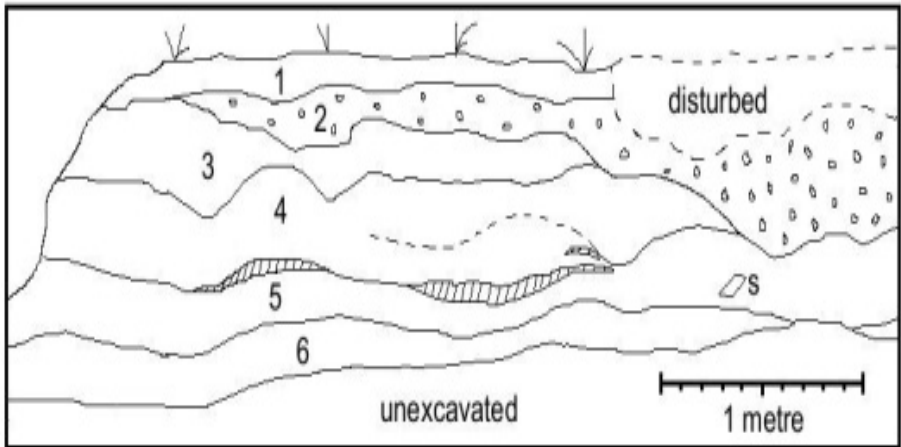


FIGURE 15: West profile: (1) sod; (2) crushed rock; (3) red clay, blocky structure; (4) brown clay; (5) grey clay; (6) red clay. Hatched layers represent traces of wood likely associated with the western end of the brushwork or decayed corduroy. The disturbed area represents a loosely consolidated portion of the profile that collapsed during machine excavation.

The heavy disturbance of the north profile combined with the high water table prevented us from picking up the shape of the original creek bed. Additional work in the form of coring and the application of Ground Penetrating Radar (GPR) may be able to detect it.

Discussion

Although other colonial-era sluices have been recovered through salvage archaeology,¹⁴ this particular sluice is one of the most studied. Its landscape context is reasonably well understood thanks to Bleakney's work (2004), and the object itself was subjected to microscopic analysis and tree-ring dating courtesy of the MAD Lab (Robichaud and Laroque 2008). We also possess some useful historical information to help flesh out its story, a summary of all of which follows.

Beginning with the functional context, it must be determined whether this sluice was some form of culvert or a part of a fully developed aboiteau. It is a significant distinction, upon which hinges much of our understanding of the early history of dyking at Grand-Pré. If the former, it was merely a drain under a road (presumably within an already dyked enclosure), and poses no serious challenge to current understandings, but if the latter, it must have formed part of a now-vanished dyke. Such a discovery would be unexpected, for as noted above, Bleakney's (2004) developmental model of dyke enclosures on the Grand-Pré Marsh identifies no dyke walls at this location.¹⁵

Those favouring the culvert interpretation must account for its having been over engineered to include a one-way valve. What purpose could this have served if the goal was simply to allow water to pass beneath a road, and how would the threat of surplus water — flowing up-slope to the north — be introduced to this creek if not by the tide? In favouring the "sluice culvert" interpretation, Dr. Bleakney, for instance, suggests that this device may have served as a "check valve" to mitigate spring flooding (personal communication, 17 August, 2009). Perhaps future research will unearth clearer evidence of sluices employed in this fashion.

14. E.g. West Pubnico, 1990; Annapolis River (Melanson site), 1996; Truro, 2004.

15. Unfortunately, even the best period mapping available, the 1760s Bishop map, sheds only a dim light on the subject, for it depicts both dykes and roads in more or less the same way. Therefore it is not always possible to attribute a drawn feature on the map to one or the other of these structures on the ground with any certainty. In many cases one may, but in this case the evidence remains, sadly, ambiguous.

Those inclined instead to regard the sluice as part of an aboiteau also have some explaining to do, for while the sluice itself is practically identical to the analogous component within an aboiteau, its surrounding architecture lacks the extensive netting of stakes and brushwork described by Dièreville and Crane, particularly the vertical stakes necessary to anchor the aboiteau against the masses of water pushing against it (see Cormier 1990, 50-54). Unfortunately, whatever dyke superstructure may have been present here has been lost to later land forming activities, and so its absence cannot be read as negative evidence.¹⁶ Moreover, the absence of vertical staking around the sluice may be explained by its situation at a relatively high and well-protected location near the center of the marsh. This aboiteau — if that is indeed what it was — would not have been regularly subjected to the large volumes of water (and the scales of force) more typically felt at lower elevations and in more exposed locations, and the rhythm of whatever waves that reached it would have been much more attenuated than that of that felt at more exposed locations. Observing the modest trickles of water creeping this way, the builders may have concluded that their wall of well-laid sod bricks and support logs was equal to the task. If so, they judged correctly.

Time depth, and the fact that this location was clearly subject to several phases of remodeling, offers a route at least part way around this difficulty. It is possible, for instance, that the sluice was installed here as a culvert after having previously served in another location: a colonial example of recycling. The apparent mismatch between the size of the planks capping the sluice and the channel itself, as well as the absence of a consistent pattern of peg holes for each of the caps, may indicate that it was cobbled together from “spare parts” (Bleakney, personal communication 17 August, 2009). Still another reading of the evidence might posit that what began as an aboiteau may have later served as a culvert after the expanding reclamation program made the overlying dyke redundant. There are several examples close at hand of dykes converted to roads by this process. The corduroy surface, along with the additional drainage elements, may have come later. Both of these interpretations appear consistent with the evidence revealed by historical research and archaeology, but while the first aligns well with our

16. The absence of the articulating dyke walls is a problem that requires further investigation, perhaps through coring, and may invite modifications to Bleakney’s model at this particular site in the marsh. The Bishop plan offers suggestions to guide future work in this direction, as do the drainage patterns preserved on archival aerial photographs. I would like to return to this subject in a later paper.

understandings of the development of Grand-Pré's dyked fields, the second does not.

Perhaps another important clue may be found in the artifact's age. As previously noted, the sluice was recovered from within Bleakney's third enclosure, which he suggests was completed by the time of the 1693 census (2004, 91).¹⁷ Analysis undertaken by the MAD Lab confirmed that the sluice was fashioned out of a 274-year-old white pine: a surprisingly old tree for its modest dimensions.¹⁸ Comparing the growth rings sampled from the sluice with a white pine master chronology, Robichaud and Laroque derived a cut date of 1686. An associated red spruce support log was, by the same method, determined to have been cut in 1682 (Robichaud and Laroque 2008, 5-6). These early dates are significant, for they not only make the Grand-Pré sluice one of the oldest pieces of architectural timber yet discovered in the province,¹⁹ but they also firmly situate this construction event in the earliest phase of Acadian colonization at Grand-Pré. Tree-ring dating thus permits us to relate an otherwise orphaned object to the historical record, and perhaps to historically known personalities.

The census records from the period have become something of a dietary staple among social historians and genealogists, and many readers will be familiar with both their details and limitations. The first census of Les Mines,

17. Dr. Bleakney's dating is based on a particular reading of the period census records, some of which include the acreages of the farmsteads enumerated. By comparing the acreages of the census records to the sizes of the Grand-Pré Marsh enclosures, approximate construction dates for some of the earlier enclosures have been proposed (the later enclosures cannot be dated in this fashion because the census records that record landholdings cease after 1707). Yet while the numbers in the censuses and the acreages on the ground do happen to coincide, I have some reservations about this method. My main concern is that many of the families listed in the census records were not living near Grand-Pré at the time of the count. Martin Aucoin's family, to take just one case, can be shown to have occupied land in the Canard River Valley from the 1680s right through to 1755. Their landholdings, in other words, should belong to other marshes.

18. André Robichaud, personal communication, 17 July, 2006. This kind of morphology is not unknown among trees that grow within a climax woodland environment, in which a high and well developed canopy limits a younger tree's access to direct sunlight, but it may also have been living in a marginal environment (André Robichaud, personal communication, 9 July, 2006).

19. Given that it was still functioning — despite being practically clogged with mud — when we found it, it must also stand as one of the better examples of craftsmanship in the province. There would have been no need to purchase an extended warranty plan for this little item.

penned in 1686, records 57 inhabitants living in 10 households, but unfortunately does not situate them in the landscape.²⁰ For this level of detail we must jump ahead to the 1701 census, which associates the inhabitants to the river valleys in which they resided.²¹ Assuming a general level of continuity in land tenure over the intervening years, a process of collation allows for a tentative reconstruction of the Grand-Pré settlement in 1686.²² It appears to consist of only two households: those of Pierre Mellanson and Louis Noel La Bauve, whose land holdings are indicated in Table 1. If we take Dièreville at his word, accepting his contention that the dykelands were often “owned by several Men, [and] the work upon them is done in common...” then we may need to look no further than this list to identify the builders of our sluice (Webster 1933, 95).²³

TABLE 1: Families and Land Holdings at Grand-Pré in 1686

| HOUSEHOLD | LAND (ARPENTS ²⁴) | LAND (ACRES) | LAND (HECTARES) |
|---------------------|----------------------------------|-----------------|--------------------|
| Louis Noel La Bauve | 150 | 0.8 | 0.3 |
| Pierre Mellanson | | 42.2 | 17.1 |
| TOTAL | 51 | 43.1 | 17.4 |

20. *Archives nationales d'outre-mer* (ANOM), COL G1 466/35 p., fol. 18-20. Nor is it, judging from a comparison with father Moireau's baptismal records, necessarily complete. Cf. Library and Archives Canada FM 16, B2, 1, p. 15-17, 30-31.

21. *Archives nationales d'outre-mer* (ANOM), COL G1 466/10p. *Recensements des Mines*: i-j.

22. One presumes this was the method Rameau employed, though he is not explicit on this matter (1877, 173).

23. The meticulous work of settlement pattern reconstruction may further clarify this picture. Place name evidence, for instance, situated the Melanson village in the Gaspereau River Valley by the mid-18th century. And of course, if our sluice was recycled as a culvert rather than an original aboiteau construction, then this census-based speculation can go right out the window.

24. Defined by Clark as approximately 0.845 acres (1968, 87, n 32).

Yet several important questions remain. First, this approach to settlement reconstruction creates a serious lack of agreement between the size of the dyke enclosures derived from Bleakney's model and the landholdings of the farmers who can be shown to be living at Grand-Pré in the year in which the sluice was likely to have been installed.²⁵ In 1686, the census counts 17.4 hectares under cultivation at Grand-Pré, while Bleakney's first enclosure alone (Figure 3, #1, above) — which is separate from the area in which our sluice was recovered — contains 42.8 hectares (Bleakney 2004, 91). Perhaps the census taker counted only those portions of the enclosure under active cultivation rather than the enclosure's full extent (Clark 1968, 238), or maybe the inhabitants purposefully under reported their acreage. Perhaps — building on Dièreville's comments — parts of the enclosures were owned by others living outside the community. There is some suggestion of this in the primary sources.²⁶ It could be that the inhabitants of the neighbouring rivers in the initial decade or so of settlement elected to pool their resources to work the Grand-Pré. Such a strategy might have made efficient use of scarce labour, but it would have necessitated an awkward and ultimately unrealistic commute for labourers. True, this interpretation brings the census numbers for Minas in 1686, 1693, and 1701 into line with Bleakney's enclosures on Grand-Pré (2004, 91), but it seems odd that these families would have neglected to enclose the land adjacent to their own homes, for example in the Canard Valley, much of which could have been relatively easily effected with the construction of running dykes, the remains of which are in fact clearly visible on early aerial photographs.

However puzzling they remain, these discrepancies between the historical record and the material cultural record are real and significant. With one hand, they prompt us to acknowledge that our understanding of the earliest phases of dyke building at Grand-Pré may yet undergo some revision, while on the other, they hold out the opportunity for future discoveries that may continue to refine Bleakney's model. This future research should challenge some of our assumptions, and ought to consider the possibility that the Acadian dyking effort at Grand-Pré may not have commenced with running dykes extending from the upland, at or near the location of Grand-Pré National Historic Site, as common sense would appear to suggest

25. We assume here that the spruce post cut in 1682 and the white pine for the sluice cut in 1686 were installed soon after the latter date rather than left in a supply yard for an extended period of time.

26. E.g. Caulfield to Nicholson, "1714" (probably May-June), Governor's Letter Book, Annapolis, 1713-1717, Nova Scotia Archives II, p. 7.

(Bleakney 2004, 81-84; Cameron 1958, 370). Instead, the inhabitants may have started out in the middle section of the marsh. Disconnected “ring dyke” enclosures of this sort have been noted in Europe (Rippon 2000, 46-47), and they offer an example of the kind of strategy that may have been employed here, if our sluice was in fact an aboiteau.

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