

Archaeological Research Report
HERITAGE RESEARCH PERMIT A2006NS53

Archaeological Salvage Excavation
of a 17th-Century Acadian Sluice
from the Grand-Pré Marsh



Jonathan Fowler
Northeast Archaeological Research
53 Aspen Crescent
Lower Sackville, Nova Scotia
B4C 1C8

tel: (902) 865-4585
cell: (902) 478-1896
fowler@ns.sympatico.ca
www.northeastarch.com

24 December 2006

Contents

Acknowledgements.....	2
Introduction.....	3
Historical Background.....	4
Methodology.....	10
Results.....	10
Discussion.....	18
References Cited.....	22
Appendix: Article – ‘Grand-Pre abuzz over aboiteau’.....	23

List of Illustrations

Figure 1: Site location map.....	3
Figure 2: Initial cleaning of the sluice.....	4
Figure 3: Dr. Bleakney’s dyking sequence.....	5
Figure 4: Site location (air photo and archival map overlay).....	8
Figure 5: Site location 1945 air photo.....	9
Figure 6: André Robichaud extracting a tree ring sample.....	10
Figure 7: Drainage ditch profile.....	11
Figure 8: Mechanical excavation.....	12
Figure 9: Cleaned sluice and corduroy.....	12
Figure 10: Labeled sluice and corduroy features.....	13
Figure 11: Sketch of sluice and associated features.....	14
Figure 12: Plan drawing of sluice and corduroy.....	15
Figure 13: Plan drawing of sluice.....	16
Figure 14: North profile.....	17
Figure 15: West profile.....	17

Acknowledgements

A number of people contributed their time and energy to the recovery, protection, and study of this sluice, and although several of them are named in the following pages, I would like to take a moment before we begin to acknowledge their contributions.

Robert Palmeter should be thanked at the very start for contacting Grand-Pré to report the find. Donald Kennie, as landowner, extended every courtesy to our team, allowing us ample time to excavate the remainder of the sluice and properly document its context. Without their assistance, none of the following would have had a chance to take place.

Victor Tétrault, Executive Director of the Société Promotion Grand-Pré, co-ordinated our initial response, providing leadership in the critical early phase, then staying with the project as it evolved to help guide it to a successful conclusion. Rob Ferguson, Parks Canada Archaeologist, not only assisted with the planning process leading up to the sluice's recovery, but also jumped right into the pit when the time came, personally overseeing the removal of the sluice caps. Colleen Day and Amanda Thomas, Parks Canada Conservators, advised us in the field and took on the task of protecting the sluice once we had removed it from its muddy home. Without their skill, the object itself would soon be warped and destroyed by the forces of decay. Wayne Kelley, Parks Canada Assets Officer at Grand-Pré National Historic Site, arranged for the equipment needed for the salvage project and provided essential help in transporting and storing the sluice. As always, his staff was excellent.

Dr. Sherman Bleakney devoted many hours to our discussions, site visits, and countless rounds of email speculation. In the end, from an academic standpoint, his work on Grand-Pré's cultural evolution provided the most compelling evidence concerning the site's context that we have yet been able to muster. André Robichaud, of Mount Allison University's Dendrochronology Lab, provided essential dating evidence, demonstrating the power and the potential of this as yet under-utilized technique in Maritime Archaeology.

My field team was a fine assortment of colleagues and friends, several of them participants in the Grand-Pré Archaeological Field School Project. They are Guy Allen-Hermanson, Sara Beanlands, Matt Cloutier, Robert Shears, Jeff Turner, Maxine Allen, Cynthia Cormier, Stephen Cormier, Morgan Cowan, Robyn Crook, Donna Matheson-LeFort, Jessica McPhee, Matt Munro, Josh Nash, Steven Uloth, Alie Whalen, Cassandra Whalley, and Andrea Wilson.

Collectively, the efforts of the individuals named above (and many others) have not only made this a successful salvage archaeology project. More significantly, they have dramatically raised the bar in terms of how we respond to archaeological crises. This project saw two governmental bodies (Parks Canada and The Nova Scotia Museum), a community organization (the Société Promotion Grand-Pré), and two universities (Mount Allison and Saint Mary's) quickly join forces with concerned members of the public to rescue an important part of our heritage. The archaeology detailed in the following pages is significant in itself, but there is also value in the manner in which this ad-hoc multidisciplinary team came together to get the job done. It was a great pleasure to have been a participant.

Introduction

On May 19th 2006, a machinery operator named Larry Cranton made a surprising discovery while excavating a drainage ditch within the Grand-Pré Marsh (**Figure 1**). With a slight tug, followed by a snap, the steel bucket at the end of the great hydraulic arm brought up the broken end of a wooden sluice and two additional logs. Suspecting the find might be significant, Robert Palmeter, who had stopped by the find site a short time later, contacted Wayne Kelley 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 have preoccupied a group of researchers for the past several months, and this report seeks to provide some preliminary answers. It describes the archaeological salvage excavations of the remaining in situ elements of the sluice, notes what we have learned from this process, and proposes how we might expand on this work to better understand the cultural history of the Grand-Pré Marsh. The latter point is particularly significant as Parks Canada, the Société Promotion Grand-Pré, and our partners in the local community move forward with Grand-Pré's UNESCO World Heritage Site nomination process. In light of this process, our unexpected guest's arrival is actually very timely.

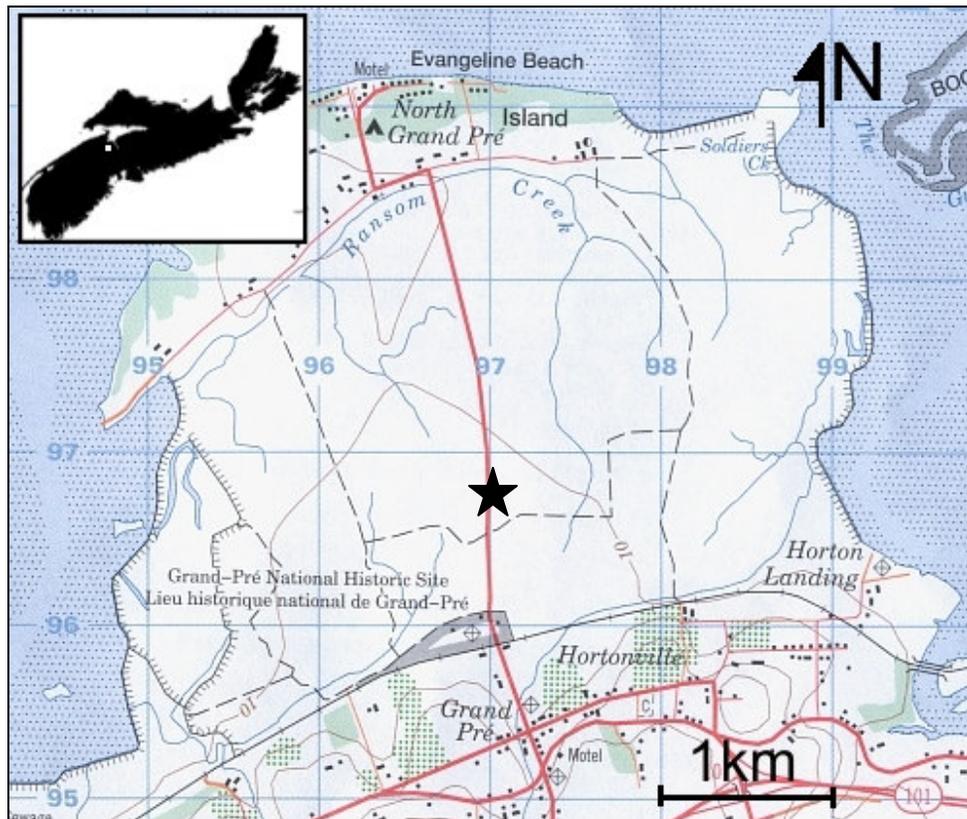


Figure 1: Site location map. The black star indicates the general location of the site. SOURCE: National Topographic Series 21H/1 Wolfville (2000).

Historical Background

The recovered portion of the sluice was transported to Grand-Pré National Historic Site of Canada by Wayne Kelley (Asset Officer at the national historic site) and his staff on 19 May. 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 it was heavily waterlogged, and the water itself was providing much of its structural support. They therefore constructed a temporary water tank in order to stabilize the sluice while the decision making process unfolded. Prior to inserting the object into the tank, they cleaned it with a pressure sprayer (**Figure 2a**).¹ This cleaning gave us our first good look at the object, 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 portable) nature, it was removed to the Parks Canada Conservation Lab in Dartmouth for treatment.

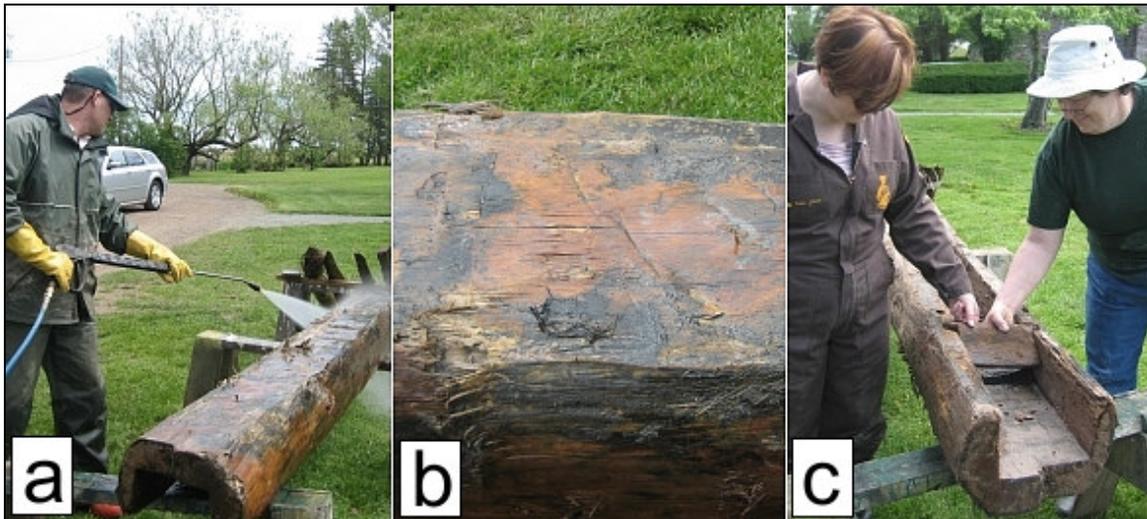


Figure 2: The initial cleaning of the sluice. (a) Stephen Coldwell, of Parks Canada’s Grand-Pré staff, cleans the mud from the underside of the sluice with a pressure sprayer. The end of the sluice closest to the camera is the finished end through which the water exited the sluice when it was working. (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.

It would be too much to state that the discovery of the sluice created a panic, but it did create something of a sensation, as well as raise some immediate – and potentially challenging – questions (one contemporary newspaper report is printed in **Appendix A**).² 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 was one of the earliest to have been dyked by the Acadians. A sluice in this location would

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

² The discovery was also reported by CBC Radio-Canada, CTV News, and CBC Television.

therefore have to be very old, and it would be a surprise if it had survived undisturbed for so long. The second reason was that, upon closer inspection, it soon became evident that there are no known dyke walls in this location. A brief digression is necessary here to explain the significance of this fact.

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). Bleakney's model is based primarily on a study of the marsh's natural drainage system, over which he superimposes a map of the largely relict network of dyke walls. This represents a significant improvement over the initial efforts by Cameron (1958), who focused on plotting the dyke network through aerial photography but ignored the underlying drainage patterns that caused the system to function. If Cameron gave us the bare bones, Bleakney stitched them up in flesh and charted out a circulatory system. With the drainage system and dyke walls accurately plotted, a few basic assumptions finish the job: 1. newer dyke walls will abut older dyke walls (or the upland) and not vice-versa; and 2. water flows downhill. Bleakney's resulting sequence of enclosures is shown below (**Figure 3**).

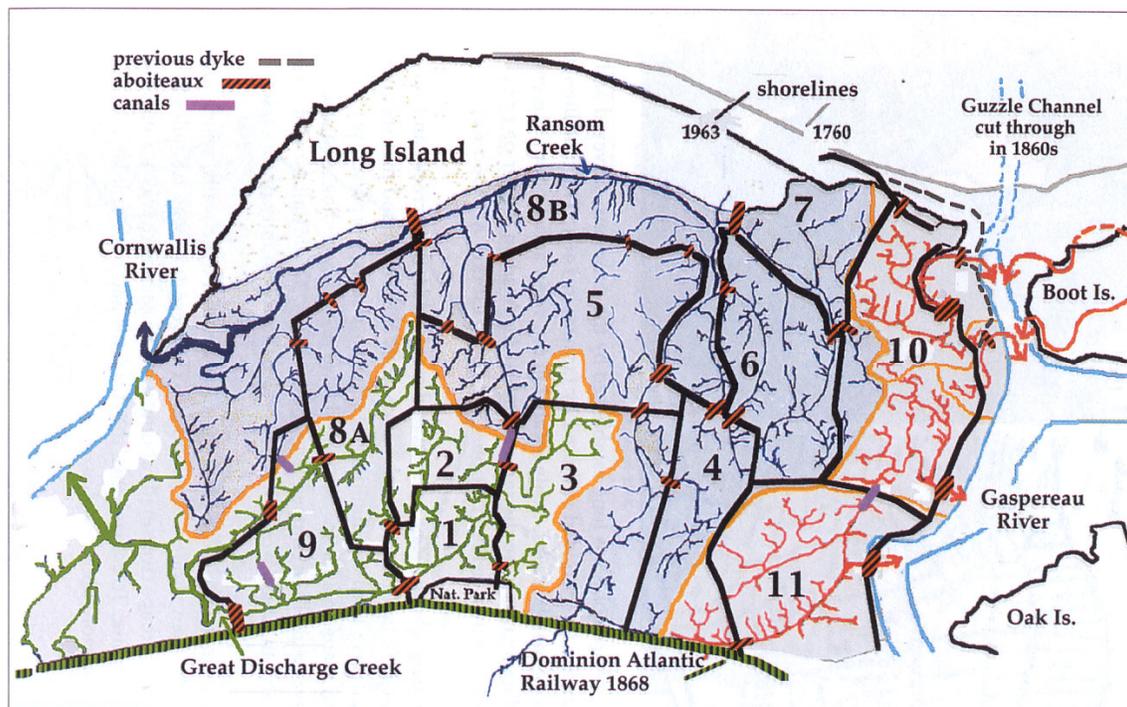


Figure 3: Bleakney's developmental model of the Acadian dyking sequence at Grand-Pré. The black lines depict Acadian dyke walls while the coloured, curved lines indicate the marsh creeks that form the marsh's natural drainage system. The numbers indicate the sequence in which each section of the marsh was dyked. Our sluice was associated with the deeply curved creek just to the left of the top of the number 3. Source: Bleakney 2004, p. xxiii.

As Figure 3 demonstrates, the recently discovered sluice comes from an area *within* block 3 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 the dyke network itself. As such, it ought to be connected to 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; Ross 2002), and much that has been published is based on only a handful of primary accounts. Chief among these is the relation provided by Sieur de Dièreville, who visited Port Royal in 1699 and published an account of his voyage in France in 1708 (Webster 1933).³ 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 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 (95).

This passage contains treats for the historical geographer as well as the social historian, and we will return to the latter in due course, but for the moment the architecture of the Acadian aboiteau deserves emphasis. Critically, it is situated within a creek bed (“where the Tide enters the Marsh”), and it is supported by a significant structure comprised of wood (“rows of logs”). These observations of Dièreville’s are confirmed by other eye-witnesses, most notably Jonathan Crane (1819), a New England Planter who was well accustomed to working on the dykelands, perpetuating the techniques introduced by the Acadians. He maintains that the wooden elements around the sluice were essential to prevent the entire structure of the aboiteau (which he defines as that portion of the dyke wall, including the sluice, which is situated astride a creek) from slipping with the pressure of the water that periodically builds up against it. To properly anchor the aboiteau, “pickets ought to be drove plentifully through it...” (1819).

According to Dièreville, the Acadians used the term “Aboteaux” to refer to the dyke as well as the sluice (1933, 94). The term appears to have originated in France prior to the

colonization of Acadia, but I have not yet ascertained its precise meaning (or more likely meanings) in the European context (see Hatvany 2002).⁴ Back in Nova Scotia, Crane also indicates that the aboiteau is a particular section of the dyke wall that crosses a creek and contains a sluice. This element of the network, which is key to the proper functioning of the whole system, requires special attention, and this is why he is at pains to describe it. It is in this broad, 'sluice-and-dam' sense, that the term is employed 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," probably signifying that the entire structure has washed out rather than that the sluice itself has been compromised. 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 since coming to the colony in 1746 (DCB). Despite these historical usages of the term, it has become conventional today to refer to the wooden sluice itself as the aboiteau. This is fair enough, so long as we recognize that this is a term that brings with it a certain amount of ambiguity.⁵ For my part, I have elected to use the term *sluice* when referring to the object under examination in this report, for reasons that will become clear presently.

Bleakney's model of the Acadian dyking sequence at Grand-Pré benefited from a surviving survey of the marsh drawn up in 1760 by John Bishop (2004, 75).⁶ This large scale plan is the single most important source available for understanding the Acadian dyking system at Grand-Pré, and it plots not only the network of dyke walls as they existed in the mid-18th century, but also the various roadways and field divisions. By reconsidering our site location in light of this 1760 plan, with one eye still on Bleakney's model, we immediately learn a great deal: our sluice is located near the intersection of five roads, and at a point where one of these roads crosses a creek. **Figure 4** displays a rough 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 best in an aerial photograph from 1945 (**Figure 5**).

This, with a little less refinement, was 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 much more like a culvert sluice. Yet it was still located in an area of the marsh that was, according to Bleakney's model, among the earliest to be enclosed. The possibility existed that this was a very old object, but how old? More pressingly for the integrity of Bleakney's model, was it a simple culvert, as it appeared, or was it a true aboiteau, signalling the existence of a previously unknown part of the dyke system? A multidisciplinary approach would soon shed much needed light on these questions.

⁴ 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).

⁵ As a point of interest, a possible early, much more cryptic, and very often ignored use of the term can be found in the 1671 census of Acadia, which notes at Port Royal "24 boisseaux" under the heading "recolte." This could be a reference to aboiteaux (Butzer 2002, 467).

⁶ The plan is labeled 'Plan No. 2' and was drawn by John Bishop. It may be found at the Nova Scotia Department of Natural Resources, Kentville, where it is filed as plan no. 5-13-A 1760.

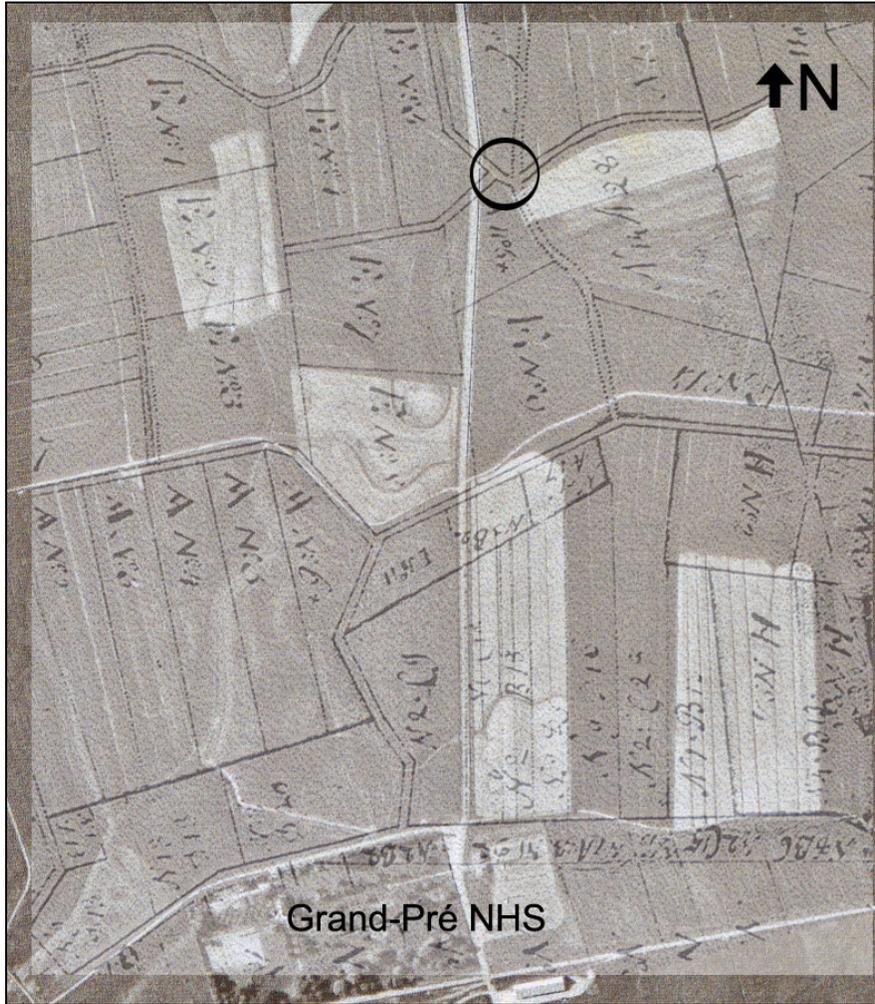


Figure 4: Site location (centre of black circle) on compiled air photo and 1760 map. This plan is not registered, and is intended for illustration only. The plan overlay is approximately scaled and modified to 40% opacity using Adobe Photoshop. Photo source: A-19985-170, 1967.



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. Photo Source: Sherman Bleakney.

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 would turn the object over to the Société for permanent display at Grand-Pré National Historic Site. All that remained was the salvage archaeological work, for which the Société contracted Northeast Archaeological Research.

Methodology



Figure 6: André Robichaud extracting a tree ring sample from one of the posts.

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. 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 certain 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 overburden, leaving a narrow perpendicular baulk for stratigraphic recording, and 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, quite simply hemmed us in, and the additional labour by hand would have significantly extended our time in the field. 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 traced using heavy equipment, we cleaned the features 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 a jury-rigged 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. 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 marsh 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.⁷ 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. Just a little more confidence in our deductive reasoning to date might have provided the answers, but I confess it was induction that ultimately told the tale.



Figure 7: The 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 archaeology (**Figure 8**) and the rest of the day was spent on detail work with hand tools.⁸ 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

⁷ It may, however, have damaged and/or carried away the plank covering in this location.

⁸ 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.

preserved poles bedded horizontally just above, and parallel to, the sluice. The discovery of these poles resolved any lingering question as to the function of this sluice, for they had clearly been laid down above the sluice to form a hardened surface over which one could travel. In other words, we were looking at the remains of a corduroy road surface (**Figure 9**). An additional set of labelled close-up images is presented as **Figure 10**.



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 sluice feature prior to the removal of the corduroy road remnants.



Figure 10: The sluce 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 investigate the stratigraphic relationship between the various elements of the sluice construction.⁹ **Figure 11** provides a sketch of these elements. Plan views with the corduroy surface in place and with the corduroy removed are shown in **Figure 12** and **Figure 13** respectively.

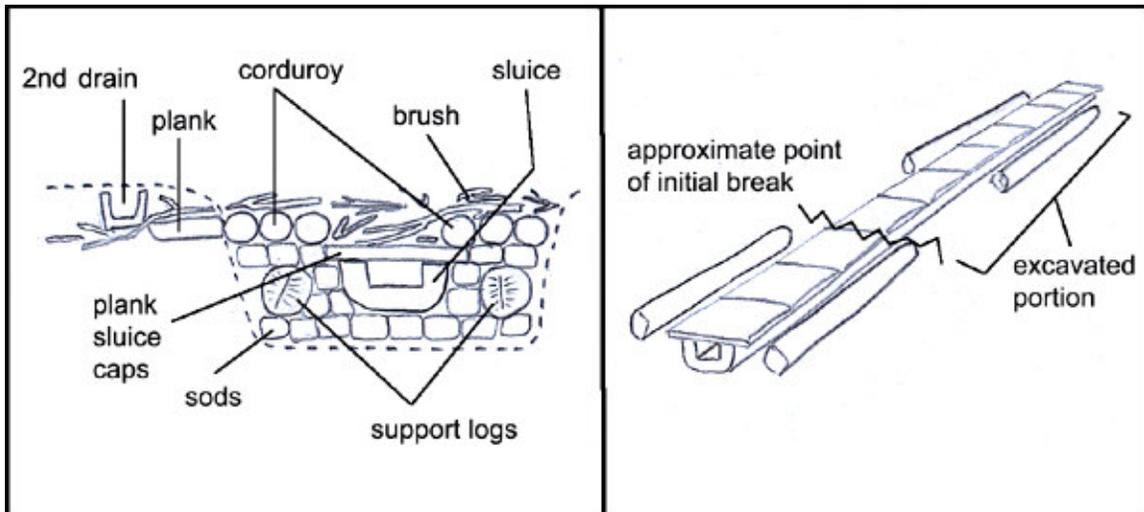


Figure 11: Sketch of the sluice and associated features. The views are from the south (l) and southeast (r), and are not drawn to scale. It should be noted that the positions of the two southern support logs are conjectural, as we were not on site to observe their extraction. Material beneath the dashed line in the left-hand image was not excavated.

The sluice itself was found to have been laid on a prepared surface of marsh sods.¹⁰ These sods also filled the spaces between the sluice and the laterally placed support logs, and were also placed under these logs. 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).¹¹ Above the sluice and lateral support logs, additional sod blocks were placed, apparently with more care, for the seams between the sods gave evidence of an alignment running perpendicular to the sluice. Upon this, the corduroy had been laid, and then brushwork had been placed on top of the corduroy surface.

⁹ 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 were delimited by hand.

¹⁰ 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 (broken) end of the sluice itself. The nature of the preserved organic material beneath the support logs and the sluice itself, 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.

¹¹ Sherman Bleakney, personal communication, 21 July 2006.

There are two significant variations in this overall pattern that deserve note: one to the west of the sluice and another directly above it. To the west of the sluice, and separated by three corduroy poles, a 20cm-wide plank was discovered at the same level as the corduroy. 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 corduroy (and higher), and the brushwork overlying the corduroy ran underneath it. This interpretation gained support by the discovery of a single wire nail associated with the channel. Traces of this structure ran the whole length of the sluice, but appear to have been badly damaged by the installation of the concrete pipe (#4 in **Figure 7**).

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 brushwork 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 (more on this below), 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 corduroy surface directly down into the sluice channel.

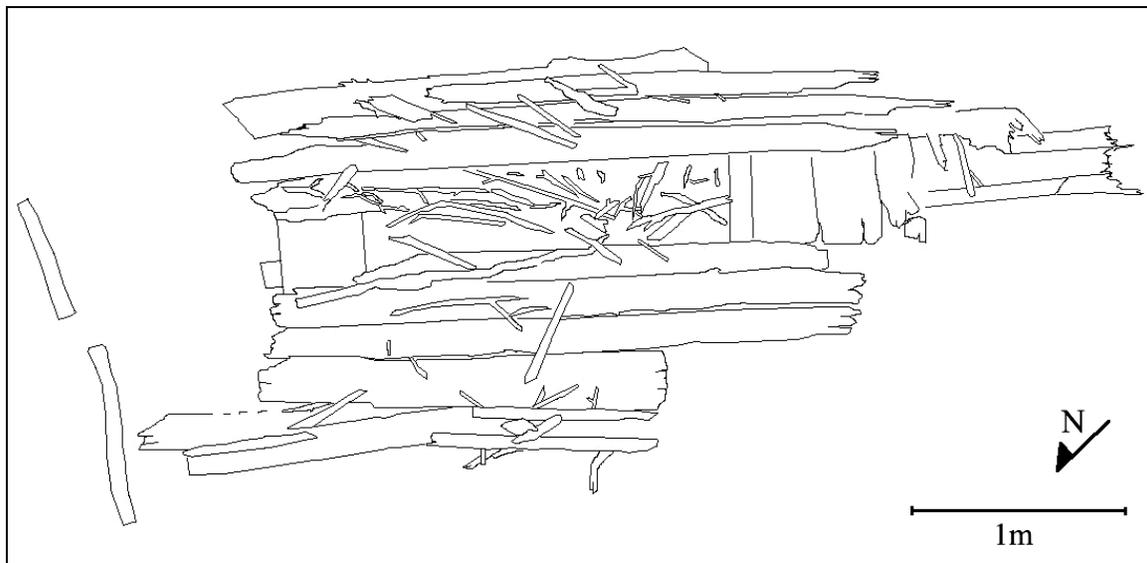


Figure 12: Plan view of the sluice with the corduroy surface still in place. Brushwork can be seen overlying the corduroy and in the gap in the corduroy surface directly above the sluice.

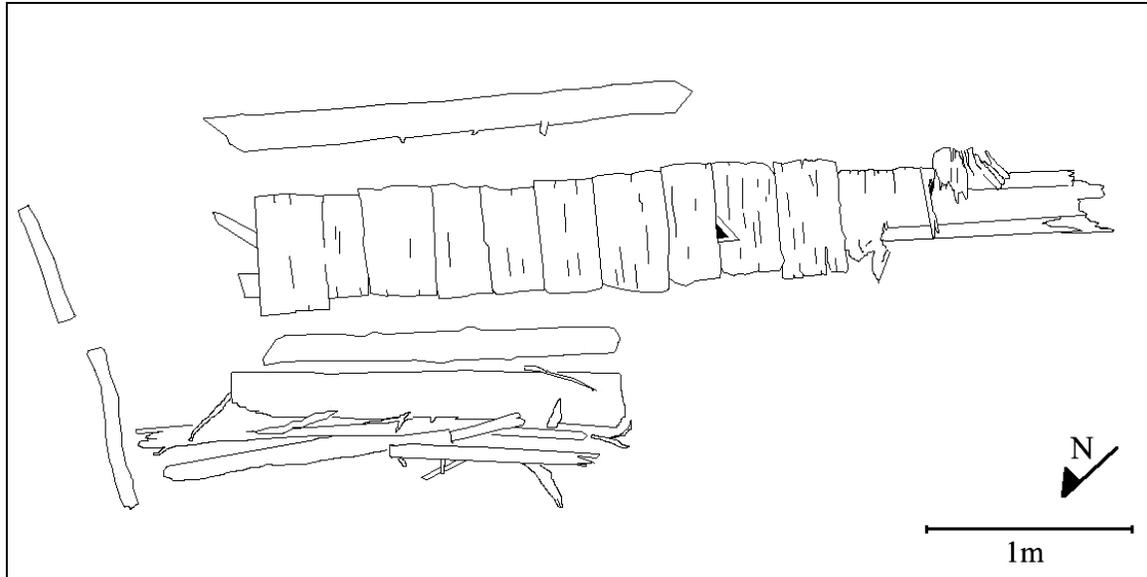


Figure 13: Plan view of the sluice with the corduroy surface removed. The cleaning process reveals the weeping drain cut into the planks covering the sluice (centre right).

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 layer of the sluice and corduroy features. 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, and still others had collapsed when the vertical sections were cut mechanically. The profiles are shown here as **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 sluice had a grade of 3.5cm over its 4.2m length.¹²

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 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. The fact that the north profile was so heavily disturbed by subsequent earthmoving prevents us from picking up the shape of the original creek bed. The fact that no evidence of it was found rather suggests that the original creek bed was broader than our excavations. If this is the case, then virtually all of the material we are seeing in the profiles is fill (indeed some of it is fill within fill).

¹² I can imagine that this wasn't measured in during installation. They might have set the sluice in place and then poured water into it to see how it carried.

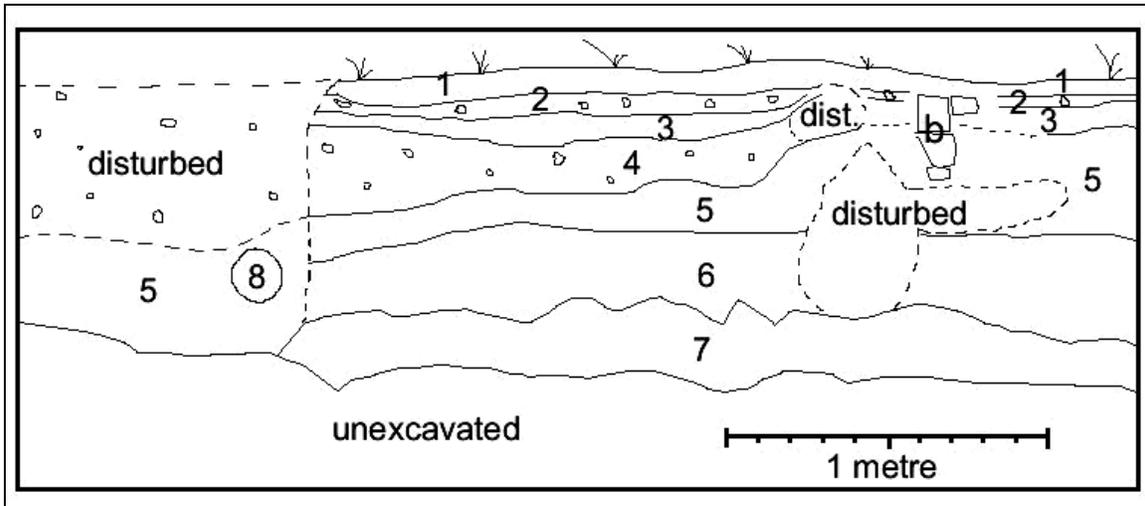


Figure 14: North profile. (1) Sod; (2) crushed rock; (3) brown clay; (4) crushed rock; (5) red clay; (6) grey clay; (7) red clay; (8) concrete pipe. Sod bricks are labelled 'b'. Disturbed areas represent portions of the profile that collapsed during machine excavation.

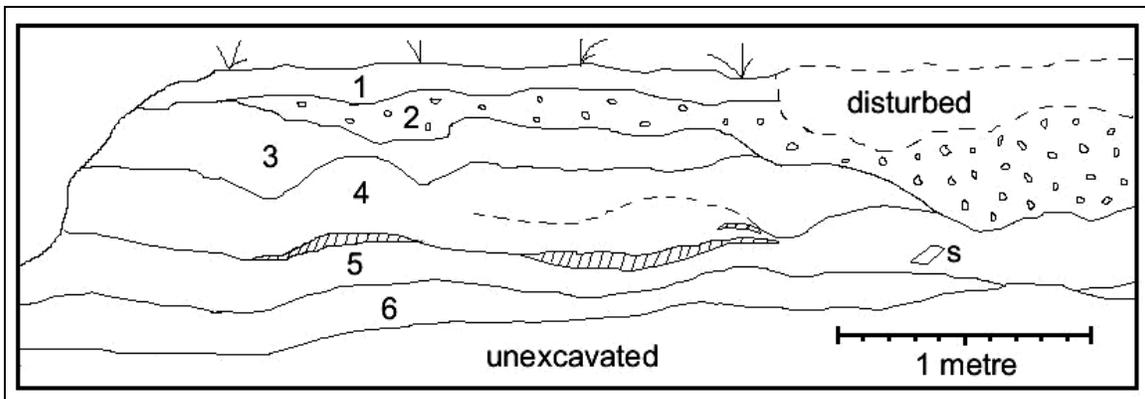


Figure 15: West profile. (1) Sod; (2) crushed rock; (3) red clay, blocky structure; (4) brown clay; (5) grey clay; (6) red clay. Hatched layers represent traces of wood likely associated with the western end of the brushwork or decayed corduroy. The disturbed area represents a portion of the profile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

Discussion

Although other colonial-era sluices have been recovered through salvage archaeology¹³, this particular sluice is probably already the most studied. Its landscape context is reasonably well known thanks to Sherman Bleakney's work (2004), as well as to Dr. Bleakney's assistance in the field during the salvage operation. The object itself was subjected to microscopic analysis and dendrochronology courtesy of the MAD Lab, and we have at least some historical information to help flesh out its story. Here, briefly, is what we know so far.

First, the object is perhaps best described as a 'sluice-culvert' rather than an aboiteau. The sluice itself is practically identical to the analogous component within an aboiteau, but its surrounding architecture (lacking an extensive netting of stakes and brushwork, and instead being installed under a corduroy road) and landscape context (part of a road system rather than a dyke wall) speak plainly to its function.

As to its date, the sluice was found within Dr. Bleakney's third enclosure, which he argues was completed by the time of the 1693 census (2004, 91).¹⁴ Independent confirmation of Dr. Bleakney's model came in the form of the dendrochronology report, and André Robichaud's analysis of the material unearthed during the spring finally bore fruit by autumn, 2006. He confirmed that the first two posts associated with sluice were red spruce and birch, while the sluice was white pine. The sluice contained at least 274 rings, making it a surprisingly old tree for its relatively modest dimensions.¹⁵ 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.¹⁶ Because the MAD Lab's master sequence for white pine was not well developed at the time of his work, Robichaud dated the sluice by association, employing samples from the red spruce post for actual tree-ring dating.¹⁷ The resultant date derived through dendrochronology was in the mid-1690s¹⁸ – an excellent result, and one which

¹³ E.g. West Pubnico, 1990; Annapolis River (Melanson site), 1996; Truro, 2004.

¹⁴ 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 with the size of the Grand-Pré Marsh enclosures, approximate construction dates for some of the earlier enclosures may be proposed (the later enclosures cannot be dated in this fashion because the census records cease after 1714). While the numbers in the censuses and the acreages on the ground do 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 be occupying land in the Canard River valley from the 1680s right through to 1755. Their acres, in other words, belong in other marshes. And yet the numbers do seem to match.

¹⁵ André Robichaud, personal communication, 17 July 2006.

¹⁶ André Robichaud, personal communication, 9 July 2006.

¹⁷ The assumption here – and it is a perfectly sound one – is that the sluice and the post were probably cut down around the same time and installed during one construction event.

¹⁸ André Robichaud, personal communication, 2 October 2006. Additional work on the master sequences for white pine and red spruce in Nova Scotia should give us more confidence in this date by late 2007.

recommends this humble object as perhaps the oldest piece of timber architecture in the province.¹⁹

The strong dendrochronology date allows us to relate the sluice and the construction event to a known historical record. In fact, it allows us to speculate as to some of the individuals who might have been involved, for Grand-Pré in 1695 was still a relatively small community. The census records from the period are usually blind to the finer details of settlement geography, for the census takers rarely subdivided the population into smaller units than the region of settlement. In this case, most of the counts list families living at ‘Les Mines’ or ‘Minas’, and good luck to the researcher who wants to learn more. However, in 1701 and again in 1714, census takers listed families by river valley. Assuming relative stability in Acadian landholding practices, and working back from the known settlement geography in these counts to the foggier picture portrayed by the others, it is possible to reconstruct the development of Acadian Grand-Pré. Using the census records up to 1693, it looks something like this:

1686²⁰

Household	Land (arpents²¹)	Land (acres)	Land (hectares)
Louis Noel de LaBove	1	0.8	0.3
Pierre Mellanson	50	42.2	17.1
Total	51	43.1	17.4

1693²²

Charles Babin	6	5.1	2
André Celestin (blacksmith)	0	0	0
Jean Doucet	8	6.8	2.7
Pierre Granger	6	5.1	2
Louis LaBauve	5	4.2	1.7
André LeBlanc	8	6.8	2.7
Antoine LeBlanc	16	13.5	5.5
Rene LeBlanc	16	13.5	5.5
Vincent Longuespee	1	.8	0.3
Pierre Mellanson	25	21.1	8.5
Pierre Richard	6	5.1	2
François Rimbaut (miller)	0	0	0
Pierre Vincent	5.5	6.5	1.9
Total	102.5 arpents	86.6 acres	35.0 hectares

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 particular item.

²⁰ Census source: Centre Acadien, Université Ste-Anne, Pointe-de-l'Église, Nouvelle Écosse.

²¹ Defined by Clark as approximately 0.845 acres (1968, 87, n 32).

²² Census source: Centre Acadien, Université Ste-Anne, Pointe-de-l'Église, Nouvelle Écosse.

If we take Dièreville at his word, and accept his contention that the dykelands were often “owned by several Men, [and] the work upon them is done in common...” then we may have to look no further than this list to find the builders of our sluice (Webster 1933, 95).²³

With all that we have learned, several important questions remain. For instance, there is a 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 1686, the census counts 17.4 hectares under cultivation at Grand-Pré, while the first enclosure contains 42.8 hectares (Bleakney 2004, 91). By 1693, the 35 hectares counted are still a little low for enclosure 1, and far too few for either enclosures 1 and 2 (86.5 ha), or enclosures 1, 2, and 3 (a combined size of 218.5 ha). What is going on here? 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.²⁴ It could be that the Acadians living along 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 commute for labourers, who probably would have traveled to the fields by canoe. This interpretation brings the census numbers for Minas in 1686, 1693, and 1701 into line with Bleakney’s enclosures (2004, 91), but it seems odd that these families would have neglected to enclose the land adjacent to their own homes, much of which would have been relatively easily done by the construction of running dykes. Alternatively, following Clark, it is quite possible that the Acadians of Grand-Pré used only a portion of their enclosed land for arable production (1968, 238).

The manner in which the sluice was installed also raises some questions. As noted above, the marsh sods around and under the sluice were composed of *Spartina patens*, a common salt marsh grass most often found on the high marsh. Appealing to the least effort principle, we might expect these sods to have been cut very near the work site, very probably just adjacent to the creek. If so, the road may have been constructed soon enough after the third dyke enclosure that this enclosure still contained salt marsh grass. Presumably arable production would obliterate these sods, forcing the builders to haul them in from elsewhere. Again, if portions of the enclosed marsh were not put into arable production, the salt marsh grasses might have continued growing for some years.²⁵ Indeed, this desire to have stores of building material (marsh sods) close at hand might have provided a rationale for leaving tracts of enclosed land to the *Spartina*.

Above all, I remain perplexed by the fact that this sluice was provided with a clapet (**Figure 2c**). Why should a culvert, powered by the force of gravity acting upon the water

²³ And we will narrow the list further once the meticulous work of settlement pattern reconstruction is advanced, for not all of the families on this list necessarily farmed at Grand-Pré. Place name evidence, for instance, situated the Melanson village in the Gaspereau River Valley.

²⁴ E.g. Caulfield to Nicholson, ‘1714’ (probably May-June), Governor’s Letter Book, Annapolis, 1713-1717. Nova Scotia Archives II, p. 7.

²⁵ Sherman Bleakney has been growing *Spartina patens* from transplanted sods in his back yard in Wolfville for the past several years and they are still growing strong. Following his lead I planted two *Spartina* sods in my back yard in Halifax in 2004 and they are still alive and kicking.

in the creek, require a one-way valve to function? Nature would already have provided for a southerly flow through the creek bed. The installation of the clapet presumes the opposite could occur and, moreover, that the builders were keen to prevent it. The most obvious cause of such an inundation is the tide, but the tide should have come nowhere near the south side of this sluice. Spring flooding might have caused the creek to fill and back up, and the one-way valve would at least have prevented this, speeding the rate at which the land dried to the north of the road and sluice, and possibly allowing those dryer fields to be sown earlier. Whatever the builders' intentions, this discovery adds one more layer of complexity to our knowledge of Acadian engineering practices.

Finally, there is much more work to be done on the sluice itself. The preliminary dendrochronology date requires some additional work, and our detailed analysis of the sluice's various anthropogenic attributes has really yet to begin. Here we have plenty of tool marks to keep us busy, including a bored hole at the object's upstream end, and a curious notch – which could only have been intentional – at the unbroken downstream end. The functions of both are unknown, but, as with the rest of it, we'll sort it out in time.

References

Bleakney, S 2004, *Sods Soil and Spades: The Acadians of Grand-Pré and their Dykeland Legacy*, McGill-Queens University Press, Montreal.

Butzer, K 2002, 'French Wetland Agriculture in Atlantic Canada and Its European Roots', *Annals of the Association of American Geographers*, vol. 92 no.3, pp. 451-470.

Cameron, H 1958, 'History from the Air', *Photogrammetric Engineering*, June. Copy available at PANS VF vol. 7, #10.

Clark, AH 1968, *Acadie: The Geography of Early Nova Scotia to 1760*, University of Wisconsin Press, Madison.

Cormier, Y 1990, *Les aboiteaux en Acadie: Hier et aujourd'hui*. Université de Moncton, Moncton.

Crane, J 'On Diking', *Acadian Recorder*, 27 February 1819. Transcribed by Sherman Bleakney, 2001.

Hatvany, M 2002, 'The Origins of the Acadian Aboiteau: An Environmental-Historical Geography of the Northeast', *Historical Geography* vol. 30, pp. 121-137.

LeBlanc, B & LeBlanc R-G 1993, 'La culture matérielle traditionnelle en Acadie', in Jean Daigle (ed.), *L'Acadie des Maritimes*, Éditions d'Acadie, Moncton, pp. 601-648.

Ross, S 2002, *Les digues et les aboiteaux: Les Acadiens transforment les marais salés en prés ferties / Dykes and Aboiteaux: The Acadians Turned Salt Marshes into Fertile Meadows*. Société Promotion Grand-Pré, Grand-Pré.

Webster, JC (ed.) 1933 [1708] *Relation of the Voyage to Port Royal in Acadia or New France by the Sieur de Dièreville*. The Champlain Society, Toronto.

Appendix A

Grand Pre abuzz over aboiteau

John DeCoste, The Kings County Register, 25 May 2006



Staff at Grand Pre’s national historic site was abuzz May 19 following the accidental discovery of a virtually-intact Acadian aboiteau.

The apparatus, constructed by the Acadian pioneers to control the tides and reclaim land for farming, was uncovered by local excavators that morning while ditching on private land about a kilometre north of the Grand Pre visitors’ centre.

Park executive director Victor Tetrault termed the discovery “both exciting and significant.” The aboiteau was not only found in its original location, but also appeared to be “virtually intact in terms of the working apparatus.

“For a site like ours, it’s like winning the lottery,” he said. “There have been pieces of them found here, but not virtually the whole thing.”

Along with its historical significance, “we’ll be able to clean it up and set it up on-site as a working display.”

Tetrault added, while the actual age of the aboiteau will need to be verified by experts, supervisor of maintenance Wayne Kelley, who has worked at the park for 31 years, estimates it’s “likely more than 300 years old,” dating back to the earliest days of the Grand Pre settlement in the 1680s.

“We know from our research that the village was up on the hill behind us, we know where the dykes were and we know when they were built,” Kelley said. In terms of an archeological find, “this is what it’s all about.”

Tetrault, executive director at the park since last summer, was impressed the excavator operator “had the foresight to realize what it was. A lot of people probably would have just thrown it aside.”

Actually, the operator immediately showed the find to local farmer Robert Palmeter, who called Kelley right away.

“It's an indication of the kind of relationship we've always had with the local farming community,” he said.

Park officials are especially excited the aboiteau is so well-preserved, especially the working mechanism, or clappeau - the hinged valve made of wood that shut the aboiteau against the rising tide and swung free when the tide was falling.

“We're incredibly lucky,” Tetrault said. “If they had been digging even a short distance on either side, they could easily have missed it altogether” in one direction, or damaged it beyond repair in the other.

Parks Canada officials, geologists and archeologists were expected on-site before the end of the day to examine the find. Park officials plan to clean it up and make it part of their permanent display.

To Grand Pré interpretive guide Susan Surette-Draper, who has worked at the park for the past five years and is an Acadian descendant from the Yarmouth County area, the find is “something that's real, that brings our history to life.”

“We have a lot of history here, but most of it is hidden and not visible,” she said. “We know it's there, and it's obviously not far away - not if you can dig it up that easily - but most of it isn't anything you can touch or hold in your hands.

“There's a whole culture under the ground.”