

# The Water Supply of Early Modern Amsterdam

## *A Drop in the Bucket?*

Filip Van Roosbroeck

TSEG 16 (2): 71-91

DOI: 10.18352/tseg.1081

### **Abstract**

It is often suggested that early modern Amsterdam was a thirsty city, in dire anticipation of the technological solutions that would finally provide it with the necessary quantities of potable water in the nineteenth century. However, a piped water system would have been technologically possible even a century before it was finally implemented, and in 1748 was even explicitly considered, but rejected as too inflexible and too vulnerable to sabotage. I consider this decision in its context, and show that while Amsterdam's system of provisioning changed throughout the early modern era, it was nonetheless able to meet the requirements of the city's population and its government.

### **Introduction**

The history of piped water systems in the Netherlands is relatively well-studied. As in most other countries, it is primarily a history of the later part of the nineteenth century. Historians point towards such varied causative factors as urban growth, concerns over water quality after the cholera epidemic of 1866-1867, industrial demand due to the specificities of steam engines, and reasons of urban prestige and status. The period preceding these technical innovations, however, has been studied to a far lesser extent. As a result, some contrasts have been overstated, while others have been underplayed and neglected.

In this paper, I will particularly focus on the city of Amsterdam. A system for piped drinking water was installed here in 1854, a full two decades before most other Dutch cities. This process has been studied most elaborately by Frank Geels, building on the more general work of

Thomas Hughes.<sup>1</sup> Building on Hughes's approach, which stresses the interaction between technological and contextual factors, Geels frames the introduction of piped water throughout Holland as a transition from one technological system to another: not just a matter of product innovation, but of truly wide-ranging social and cultural upheaval. In his view, changes on the macro-scale (democratization, industrialization, and so on) gave rise to niche demand for piped water systems, in turn leading to the spread of a new culture of cleanliness and a truly general demand for the advantages this technology provided. Although he acknowledges that local circumstances could vary, Geels has his eyes firmly on this broader pattern of change. This leaves Amsterdam as a bit of a puzzle, given its early adaptation of piped water, but this is explained by a 'scarcity of good drinking water' in this city,<sup>2</sup> urgently solved as soon as financial and technical innovations made it possible.

This implies that demographic pressures were more urgent here than elsewhere, and that drinking water was a distinctly unanswered need before 1854. However, this characterization of Amsterdam's prior situation concerning drinking water seems unpersuasive. The city's population level was remarkably stagnant after 1700, growing from about 200,000 inhabitants at the very start of the eighteenth century to just 224,000 in 1849, interspersed with long phases of decline and slow recovery.<sup>3</sup> If demographic pressure was a problem, it most certainly was not a new one. Furthermore, it is true that this population was in the rather unique position of having to rely solely on rainwater and water imported by boat, as both the city's groundwater as well as its surface water were unpotable. But this does not mean that drinking water was generally scarce or that supplies were universally perceived to be inadequate, as is implied by Geels and other historians framing the introduction of piped water as the 'solution to an age-old problem'.<sup>4</sup>

In fact, a closer look at the evolution of Amsterdam's water supply belies this impression of a thirsty yet static early modern experience, as the way in which the city was provisioned with drinking water changed

1 F. Geels, 'Co-evolution of technology and society. The transition in water supply and personal hygiene in the Netherlands (1850-1930) – a case study in multi-level perspective', *Technology in Society* 27 (2005) 363-398. For Thomas Hughes, see especially his *Networks of power. Electrification in Western society, 1880-1930* (Baltimore 1982).

2 Geels, 'Co-evolution', 376.

3 C. Lesger, *Het winkellandschap van Amsterdam. Stedelijke structuur en winkelbedrijf in de vroegmoderne en moderne tijd, 1550-2000* (Hilversum 2013) 193; J. De Vries, *European urbanization, 1500-1800* (Boston 1984) 271.

4 H. van Eeghen, 'De ijsbreker', *Jaarboek van het Genootschap Amstelodamum* 45 (1954) 61-75, 61.

considerably during the eighteenth century. A piped water system was even explicitly considered during its later half, but emphatically rejected in favour of an elaborate network of cisterns. This suggests that what had changed in 1854 was not the range of possible solutions to the problem, but rather the problem itself.

Rather than viewing Amsterdam as an exception to a general pattern, we might draw inspiration from other scholars working in the Hughean tradition to understand both the modalities as well as the expectations surrounding the early modern water supply as a *technopolitical regime*. That is to say, as the incarnated outcome of what was essentially a social process involving various actors with varying aims, ideologies and means.<sup>5</sup> I will examine the provisioning of water in Amsterdam during the early modern era and the changes that were made in the eighteenth century from this perspective. By examining the constraints and concerns of the population and decision makers at that time, it will become apparent why a piped water system was initially rejected and a choice for cisterns was made instead. Fundamentally, I will argue that these reasons were related to the tumult of the eighteenth century and became less pertinent over time, clearing the way for further change.

## A system of cisterns

Up until the early modern era, the population of Amsterdam was able to satisfy its water needs by a combination of rainwater and the water in its many canals. During the sixteenth century, however, a noxious combination of growing urban pollution and salinization rendered this latter source unusable. Starting around the 1530s, a significant share of the water supply was instead imported from the nearby river Vecht. This was especially the case for the brewing industry, which due to its large needs could not rely on rainwater alone.<sup>6</sup> The brewers had the largest fleet and took the lead in matters of maintenance and organization, although private water importers were also active. As such, throughout this paper I will draw especially on the brewers' archives, more specifically on their accounts – which detail, among other things, the number of boatloads

5 See: G. Hecht, *The radiance of France. Nuclear power and national identity after World War II* (Cambridge (MA)/London 2009 [1998]) and K. Adler, *Engineering the revolution. Arms & enlightenment in France, 1763-1815* (Chicago/London 2010 [1997]).

6 I. Vogelzang, *De drinkwatervoorziening van Nederland voor de aanleg van de drinkwaterleidingen* (Gouda 1954) 104-110.

of water imported each year (although unfortunately not the amount of water sold or used). These statistics were used to repartition joint costs between the fifteen to twenty brewers active in the city (the number was continually declining throughout the eighteenth century). As such, while they seem to have been recorded with considerable care to avoid discussions among the brewers, they remain silent as to the ultimate use of the water or the boats of other importers.

Also used were the minute books of the brewers' meetings. These minute books offer a varying amount of detail, but occasionally recorded statistics concerning an icebreaker they jointly operated during harsh winters, as well as descriptions of meetings with the city government. Although the private water importers left practically no trace in the archives, various urban authorities (most notably the treasury) did pay attention to the water supply: their files contain a number of reports and plans, which I reference where relevant.

The role of these urban authorities, however, was limited up until the 1780s: in 1784, the city commenced building a series of cisterns and in 1786, it took control over the icebreaker and increased its supervision over the water importers. The goal of both these actions was to secure a ready supply of potable water, particularly in the winter months when a severe frost could render canals and rivers unpassable. That is not to say that the reliability of the city's supply of water was, at that particular time, a new concern. Already in 1654, plans were discussed (although never carried out) to dig a large canal connecting Amsterdam with the Vecht river, partially in order to secure an easy water supply. A periodical succession of plans followed. In 1682, for instance, a man named Elias Sandra suggested two additional ways to bring potable water from the Vecht to Amsterdam: besides a canal, an aqueduct or a series of deep wells could be constructed. Shortly after, in 1688, Jan de Bray submitted detailed plans for a giant reservoir. However, these plans – and many others – foundered because of a number of practical concerns (not least the high financial investment they often required for benefits that were rather uncertain and limited), and a basic lack of interest from the city government, which was at this point in time more concerned with the expansion of Amsterdam and with improving the circulation of (brackish) water in the city's many canals.<sup>7</sup>

7 J.E. Abrahamse, *De Grote Uitleg van Amsterdam. Stadsontwikkeling in de zeventiende eeuw* (Bussum 2010) 307-329. No further information is known concerning Elias Sandra; it is possible that this Jan de Bray was the contemporaneous painter (1627-1697) of the same name.

However, official interest in these plans expanded throughout the eighteenth century, with the city's Treasurers investigating those plans that looked most realistic in more detail than before. One Cornelis Langevelt, for instance, proposed in 1748 to construct a pipeline and pumping system to bring fresh water into Amsterdam.<sup>8</sup> The Treasurers were intrigued enough to ask the brewers and other water importers to examine his plans; subsequently, they had a series of meetings with the hopeful inventor. The water importers were, perhaps understandably, wholly negative and considered it a vital threat to their livelihoods, while the brewers were not completely opposed. They did have a number of financial and technical concerns, but this would not have been sufficient to fundamentally condemn the proposal: initial disagreements regarding the fee the brewers would have to pay for their water, or the location of taps and collection points, were subsequently worked out as Langevelt and the brewers reached a compromise.

Langevelt suggested sourcing the water from near the city of Vreeland on the river Vecht, then part of the neighboring province of Utrecht. This might have complicated his plans had he been able to put them into practice. However, contemporaries did not voice this particular objection. The brewers did note that an arrangement would have to be worked out with the city of Weesp, which received a considerable amount of tolls from the water boats, but this was not presented as unsurmountable.

Similarly, while technical problems to be overcome during construction could certainly be expected, it is important to note that this is the case for any major piece of engineering and while the project would have been ambitious, it would certainly not have been unprecedented.<sup>9</sup> After all, aqueducts and even piped water systems could already be found throughout Europe. For instance, a small pipeline had connected Antwerp's brewers to the city moats since the sixteenth century, while the city of London had established an elaborate and sophisticated system a full century before Langevelt's plan was under consideration.<sup>10</sup> There is no evidence that Langevelt was directly inspired by these sys-

8 See the documents gathered in Stadsarchief Amsterdam, Archief van de Thesauris Ordinarius, 5039. *Ontwerpen voor de verswatervoorziening*, 799 [hereafter: *Treasury Designs*]. Again, no further biographical information concerning Langevelt is available.

9 E.g. C. Mukerji, *Impossible engineering. Technology and territoriality on the Canal Du Midi* (Princeton 2009).

10 L. Tomory, 'London's water supply before 1800 and the roots of the networked city', *Technology and Culture* 56:3 (2015) 704-737.

tems, but the technology that was involved was certainly not a mystery to the Dutch: as Tomory's study makes clear, the London piped water system used waterwheels, holding ponds and a network of leaden pipes to pump water directly to tens of thousands of individual houses.<sup>11</sup> If the burgomasters of Amsterdam had thought it necessary, such a system would have been perfectly feasible using eighteenth-century technology.

More fundamentally, however, both the brewers as well as the water importers noted that such a system would be exceedingly inflexible and vulnerable to defects or even sabotage. Langevelt's vague reassurances on this point did not assuage their unease. According to a memo they wrote after a third meeting with Langevelt, they had been satisfied on most points, but remained concerned that accidents, sabotage, or simple wear and tear would be difficult to repair in such a complex system. This would render the city's water supply exceedingly vulnerable – perhaps an understandable objection given the contemporary turmoil of the War of Austrian Succession.

Apparently, Langevelt's sole reply to these concerns was that they posed no difficulty as far as he could see, prompting the brewers to remark that it would be too great a risk to put much faith in this facile reassurance.<sup>12</sup> The Treasurers, in their final advice, recommended giving Langevelt a trial period of three years to prove that his system would work faultlessly, and to ensure that the icebreaker and the brewer's boats would remain operational to avoid potential shortfalls if the system did break down.

While Langevelt subsequently received assurances by the city government that in order to recoup his costs he would have the monopoly on selling water after his system became operational, the city itself declined to invest in his venture and Langevelt seems to have abandoned his plans due to a lack of funds. And indeed, the concern for flexibility and redundancy seems to have rendered a piped water system a non-starter even in the following decades. Instead, subsequent plans focussed on developing and expanding a system of cisterns.

Already in 1755, prompted perhaps by a very cold winter and concomitant difficulties encountered by the city's brewers, the mayors of Amsterdam commissioned a survey of religious and public buildings in the city, noting the present and potential capacity of their cisterns. However, it was only in 1784 that the city government decided to embark on

<sup>11</sup> *Ibidem*, 710.

<sup>12</sup> Treasury Designs, 799. Note by the brewer's college, 1748.

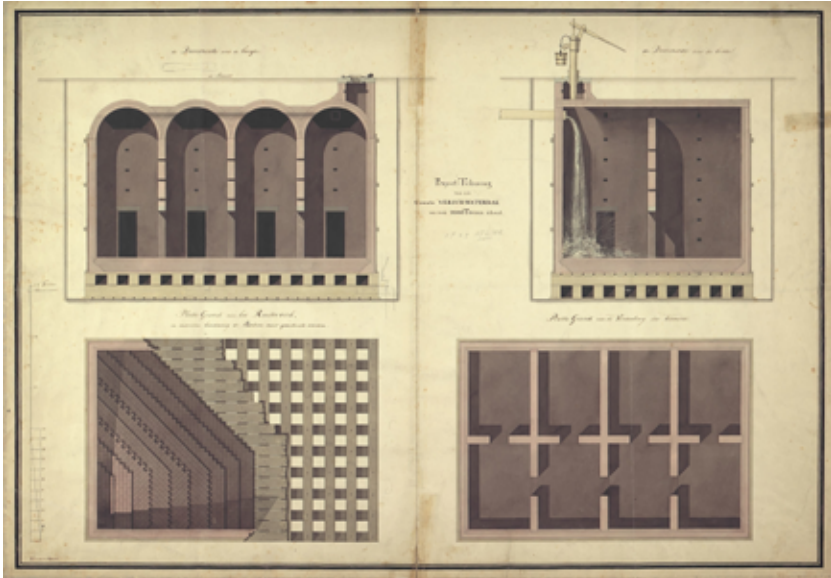


Illustration 1 Design for a cistern, 1806. Abraham van der Hart (source: Stadsarchief Amsterdam, Archief van de Dienst Openbare Werken, Centraal Tekeningenarchief. Beeldbank ID 010057000004).

a building program. Earlier criticism that a system of pumps and pipes would be vulnerable to sabotage must also have reverberated strongly in a society then bitterly divided between Orangists and Patriots.<sup>13</sup> A more flexible and resilient network of cisterns was inaugurated instead, intended not to supply the city's entire need, but to serve as an emergency reserve as well as a means by which to force the water importers to moderate their prices.<sup>14</sup> Nevertheless, the system was relatively expansive: from 1790 to 1824, a total of thirty public cisterns was built, for a total capacity of 42,866 barrels, or 4,286,600 litres.<sup>15</sup> This was clearly sufficient, as a report from 1845 indicates that most public cisterns went unopened for many years, since they were to be used only in situations of absolute scarcity – indeed, the report went on to suggest renting out a number of cisterns to water importers for storage in order to

13 See e.g. S. Schama, *Patriots and liberators – Revolution in the Netherlands, 1780-1813* (Amsterdam 2005).

14 Treasury Designs, 799. Report by Vander Hart, April 1784.

15 Stadsarchief Amsterdam, Archief van het Secretarie; Afdeling Algemene Zaken, 5181. Stukken betreffende de drinkwatervoorziening in Amsterdam, 7042. Document entitled: 'Quantiteit water welke op primo november van yder jaar in de stad kan zijn' (19-06-1824).

reduce costs.<sup>16</sup> While especially bitter winters continued to have an impact on the cost of drinking water, nevertheless the system that preceded a piped water system in Amsterdam was just as capable of avoiding scarcity and crisis, while avoiding some of its drawbacks.

What is clear, then, is not that a piped water system was a solution that was perceived as ideal long before it was financially or technologically viable. Instead, what emerges from the sources is that the existing system was considered reasonably adequate and that, when it ran into difficulties in the latter half of the eighteenth century, other alternatives were preferred. Next, we will examine how Amsterdam's system of water boats functioned prior to 1786, why it began to experience difficulties, and how these were solved.

## The source to tap

As previously recounted, in the early modern era a large amount of water was imported into Amsterdam by boat. While a number of private water importers were also active, particularly after 1700, the brewers had the largest fleet and took the lead in matters of maintenance and organization. For instance, from 1651 onwards they operated an icebreaker to open up the water route during winter – an operation which they largely funded themselves. Other water importers were allowed to take part in their winter convoys, but had to follow behind the brewers' boats and had no say over when they took place. This situation continued until 1786, when the city of Amsterdam took over ownership of the icebreaker, mandated licences for water importers and started regulating the price of the water they sold.<sup>17</sup> The icebreaker would be deployed whenever three or four boats could be found to follow it; the brewers were consulted on this by city commissioners and had to pay a fixed price per boatload of water – an arrangement that continued until 1805, when the city constructed and leased out a number of cisterns to the brewers instead.<sup>18</sup>

16 Stadsarchief Amsterdam, Archief van het Secretarie; Afdeling Algemene Zaken, 5181. Stukken betreffende de drinkwatervoorziening in Amsterdam, 7042. Document entitled: 'Pro memorie betreklyk de mid-delen van aanvoer van versch drinkwater binnen dese stad en over de verbeteringen in deselve te brengen vooral ter verzekering tegen alle gebrek by strenge winters en langduurig besloten water' (01-09-1845).

17 To wit, two to four duiten per bucket. See: Stadsarchief Amsterdam, Archief van de Thesaurisen Ordinaris, 5039. Stukken over de verswaterhaalers, 801. Ordonnance of 24-10-1786.

18 Van Eeghen, 'De ijsbreker', 74-75; R.W. Unger, *A history of brewing in Holland 900-1900. Economy,*





Illustration 2 *The icebreaker on the Amstel river, c. 1730. Tieleman van der Horst, Winter Vreugde op den Amstel* (source: Stadsarchief Amsterdam, Collectie Tekeningen en prenten. Beeldbank ID 010097000012).

Two questions present themselves: to what extent did the population of Amsterdam rely on this imported source of water, and how important were the brewers vis-à-vis other importers? The latter issue is a matter of some uncertainty in the literature.<sup>19</sup> These two groups are sometimes seen as operating concurrently, sometimes in sequence, as private water importers only rarely make an appearance in the historical record before the formation of a 'Fresh Water Society' in 1786, which represented their interests to the city government. While they used a large amount of water themselves, it is certainly clear that the brewers also supplied private individuals, at least to some extent. In 1731, for instance, they decided to no longer provide water in beer barrels, as they feared that beer subsequently stored in these barrels would spoil.<sup>20</sup> However, as long as customers sent their own barrels to the breweries to be filled, they reassured the city government, no one would be denied the sale of fresh

*technology and the state* (Leiden/Boston/Cologne 2001).

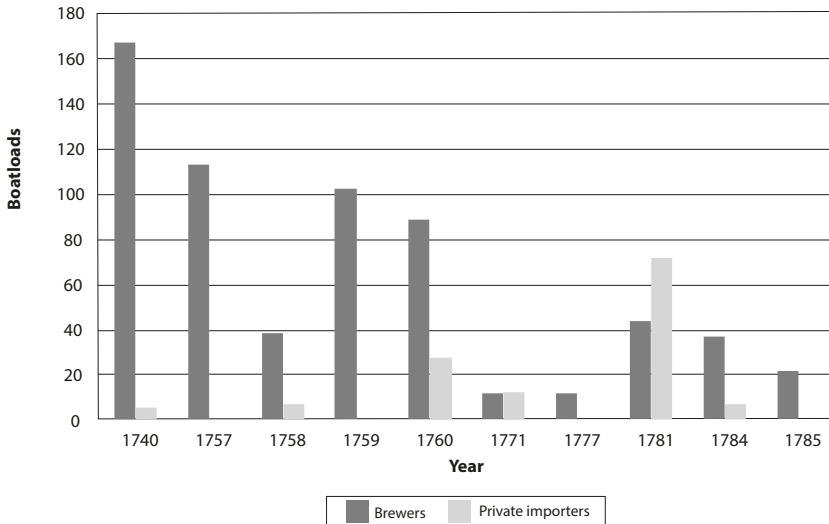
19 One can point towards practically any work listed in these footnotes for a unique interpretation of the brewers vis-a-vis the water importers, but see primarily: Vogelzang, *De drinkwatervoorziening*; Unger, *A history of brewing* and Abrahamse, *De Grote Uitleg*.

20 Stadsarchief Amsterdam, Archief van Gilden en Brouwerscollege, 366. Resolutiën en notulen, 1660. Entry of 23-04-1731 [hereafter: 'Minutes Brouwerscollege'].

drinking water. This was confirmed by one of the city mayors, who noted that he had sent his own sled to the brewery recently and had been provided with drinking water without complaint.<sup>21</sup> That urban authorities needed the reassurance and were so quick to confirm it, seems to indicate that the brewers still played a large role in water provisioning.

Concurrently, there is more than sufficient reason to nuance the role that private importers were able to play and to believe that brewers continued to provide water to others up until 1786. In 1758, a document of the brewers' society shows that there were only thirteen private water importers in the city;<sup>22</sup> these same importers supplied not only individuals, but also industries such as sugar refineries, painters, hat makers, and other industries that required a supply of clean water.<sup>23</sup> This document officially allowed this to the private importers in 1758, but this had no observable effect on the number of boats they themselves imported, suggesting that this simply formalised an existing situation.

**Figure 1 Boatloads of water brought into the city of Amsterdam by brewers and private importers during heavy winters**



Source: *Minutes Brouwerscollege, 1661-1662. Records of 1755, 1757, 1758, 1759, 1760, 1771, 1777, 1781, 1784, 1785. Minutes Brouwerscollege, 1689. Record of 1740. Private importers sent no boats in 1757, 1759, 1777 and 1785.*

<sup>21</sup> Minutes Brouwerscollege, 1660. Entry of 15-10-1731.

<sup>22</sup> Minutes Brouwerscollege, 1661. Entry of 09-03-1758.

<sup>23</sup> Minutes Brouwerscollege, 1661. Entry of 13-02-1758.

Moreover, the brewers regularly complained that the private importers were unwilling to send ships in winter because of the extra costs, leading to shortages particularly among the poor.<sup>24</sup> This complaint is borne out by the financial records of the brewers: as we can see in Figure 1, of the ten years in the period 1740-1785 for which detailed records exist, there were four winters during which private importers sent no boats.<sup>25</sup>

When they did send ships, their contribution was dwarfed by that of the brewers: in the harsh winter of 1740-1741, for instance, when the waters in and around Amsterdam were frozen for more than a month, the brewers nevertheless brought 166 boatloads of water into Amsterdam. The private importers brought five.<sup>26</sup> However, the winter of 1781 provides a counterexample, when private importers brought 114 boatloads of water into Amsterdam, compared to the brewers' 43. This might indeed suggest a growing role for private importers in the eighteenth century, as some historians suggest,<sup>27</sup> although subsequent winters saw a reversal to the previous pattern and private importers' numbers remained limited.<sup>28</sup> Unfortunately, due to a lack of archival material, the exact relationship between private importers, brewers, and consumers remains vague: besides these ten winters, there is no indication of the amount of water imported by private importers, nor do we know precisely how much water was sold to consumers or other industries rather than used for the production of beer. Furthermore, these are certainly not the only winters in which the icebreaker was required, but only the years for which detailed information was entered into the minute books.<sup>29</sup>

What was the share of this imported water, whatever its origin, in the total water supply? Many houses in Amsterdam had cisterns installed, particularly those of richer occupants.<sup>30</sup> Moreover, one imagines that

24 Minutes Brouwerscollege, 1661. Entry of 03-02-1755.

25 Minutes Brouwerscollege, 1661-1662. Records of 1755, 1757, 1758, 1759, 1760, 1771, 1777, 1781, 1784, 1785. Minutes Brouwerscollege, 1689. Record of 1740. Private importers sent no boats in 1757, 1759, 1777 and 1785.

26 Stadsarchief Amsterdam, Archief van Gilden en Brouwerscollege, 366. Rekeningen en kwitanties, 1689 [hereafter: 'Receipts Brouwerscollege'].

27 Van Eeghen, 'De ijsbreker', 70.

28 Receipts Brouwerscollege, 1689.

29 A number of receipts for other years can be found in Stadsarchief Amsterdam, Archief van Gilden en Brouwerscollege, 366. Stukken betreffende de ijsbreker en het openbijten van het ijs, 1700. Unfortunately, these files suffer to an even larger extent from incompleteness and a lack of detail.

30 E.g. J. Gawronski, R. Jayasena and T. Terhorst, 'Oostenburg. Woningen en stadsschuitenmakerswerf

even the urban poor could collect at least some rainwater by means of barrels or other containers. Izak Vogelzang argues, however, that the storage capacity of these private reservoirs was rather limited, leading to supply problems during periods of exceptionally dry or cold weather.<sup>31</sup> Thus, while he estimates that imported water accounted for only eight per cent of total consumption,<sup>32</sup> its importance stemmed from its role as an emergency buffer capacity that ameliorated shortfalls in the supply of rainwater.

Contemporaneous records support this argument. A survey of public and church cisterns was undertaken in 1755. This survey gauged both the current capacity of their cisterns as well as the possibility (and the cost) of expanding their capacity. In total, 124 cisterns were counted, for a total current capacity of 27,101 tons (or an estimated 2,710,100 litre – about enough to provide a mouthful of water to every citizen of Amsterdam each day).<sup>33</sup> Most of this water went towards providing the needs of the institutions occupying the buildings themselves (the city orphanage, the city jail, et cetera), but some of it was sold to private citizens. Moreover, the owners or caretakers of these buildings indicated that with additional cistern capacity, they would be able to provide another 144,596 tons of water, should the city decide this was necessary.<sup>34</sup> The water sales records of the *Oudezijds en Nieuwezijds Huiszittenhuis*, one of the institutions surveyed, do not indicate rising demand for their water over the eighteenth century either, which we might expect if water from other sources became increasingly scarce or expensive.<sup>35</sup> As such, both these sources indicate that there was no regular, structural shortfall in the water supply and that that there was plenty of spare capacity should such a shortfall appear.

(1660-1900), AAR (Amsterdamse Archeologische Rapporten) 99 (2017); J. Gawronski and J. Veerkamp, 'Water uit de kelder. De verdwenen waterkelders van Amsterdam', *Monumenten & Archeologie* 6 (2007) 58-69.

31 Vogelzang, *De drinkwatervoorziening*, 37.

32 Vogelzang, *De drinkwatervoorziening*, 119; Geels, 'Co-evolution', 373.

33 This is admittedly a very rough estimate. A 'water ton' contained 7.5 buckets or 90 'mingel', or about 100 liters of water.

34 The useful capacity of cisterns is limited by the surface area of the roof from which water is collected.

35 Stadsarchief Amsterdam, Archief van het Nieuwezijds en het Oudezijds Huiszittenhuis en van de Regenten over de Huiszittende Stadsarmen, 349. Rekeningen van het Oudezijds Huiszittenhuis, 245; Stadsarchief Amsterdam, Archief van het Nieuwezijds en het Oudezijds Huiszittenhuis en van de Regenten over de Huiszittende Stadsarmen, 349. Rekeningen van het Nieuwezijds Huiszittenhuis, 403. These accounts cover respectively 1762-1808 and 1749-1782. Other institutions, unfortunately, do not have surviving records for these sales.

The survey, however, adds one very important nuance: private reservoirs could vary enormously in size (something also noted by the city's archaeological service).<sup>36</sup> A 1755 survey of cisterns of public buildings and churches also included some private housing (mostly built on church land); their cisterns varied in size from 5 barrels (a 'servant's house') to 100 barrels (the houses of both a deacon and an undertaker).<sup>37</sup> Assuming an average household of five, this translates to a capacity of between 100 and 2,000 litres per person – or, put another way, given a consumption of a bucket (or c. thirteen litres) per day and a full reservoir, this meant that supplies would last either a week or more than five months!

The benefit of larger cisterns is additionally illustrated by the request of administrators of the city orphanage. The orphanage had ten cisterns, for a total capacity of 2,800 barrels, but the administrators complained that they still needed to purchase f600 worth of water (at least 60,000 buckets) yearly to make up shortages. In order to ameliorate this, they requested the construction of an additional cistern with a capacity of 1,600 tons (or 12,000 buckets).<sup>38</sup> Thus, larger cisterns not only allowed for a larger reserve, but also allowed households to make fuller use of events like thunderstorms that might punctuate drier periods and would overwhelm smaller reservoirs. The poorer parts of the city, however, were notably lacking in this infrastructure, first to run out of water during dry or cold spells, and thus were most often forced to purchase imported drinking water.<sup>39</sup> It is this particular context that explains the complaint by the brewers noted earlier: during periods of shortfall, which affected the urban poor first, the population of Amsterdam turned towards imported water. The brewers, as the largest single importer, bore the brunt of their demands – demands that, as we will see, they found harder and harder to satisfy.

36 J. Gawronski, R. Jayasena and J. Veerkamp, 'De stad in profiel. Archeologische Begeleidingen in het centrum van Amsterdam (2011-2016)', *AAR (Amsterdamse Archeologische Rapporten)* 94 (2017) 13.

37 Stadsarchief Amsterdam, Archief van de Thesaurieren Ordinaris, 5039. Stukken betreffende verlichting en drinkwater, 799 [hereafter: 'Various treasury documents'].

38 Various treasury documents, 799.

39 Vogelzang, *De drinkwatervoorziening*, 121.

## A crisis brewing

As we have seen, it is precisely during periods of drought or heavy cold that the inhabitants of Amsterdam relied most on imported water; especially the brewers met this shortfall. As long as the brewing industry was in good health, the burden was manageable, but the eighteenth century was not very kind to the brewers of Amsterdam – nor, indeed, to the brewers of any Dutch city. Richard Unger describes a general decline in beer production and consumption throughout Holland from the seventeenth century onwards, which he considers the result of the loss of export markets, rising capital costs, and the growing popularity of competing beverages such as wine and *jenever*.<sup>40</sup> The brewers themselves were especially concerned with the rising popularity of coffee and tea, and not without reason. According to Anne McCants, probate inventories show that tea and coffee consumption quickly became ubiquitous in Amsterdam even among non-elite groups. Prices of both commodities fell steeply in the first decades of the eighteenth century and continued to decline throughout the century; concomitantly the volume of trade grew steeply. By the middle of the eighteenth century, even the very poorest households owned coffee and/or tea paraphernalia.<sup>41</sup>

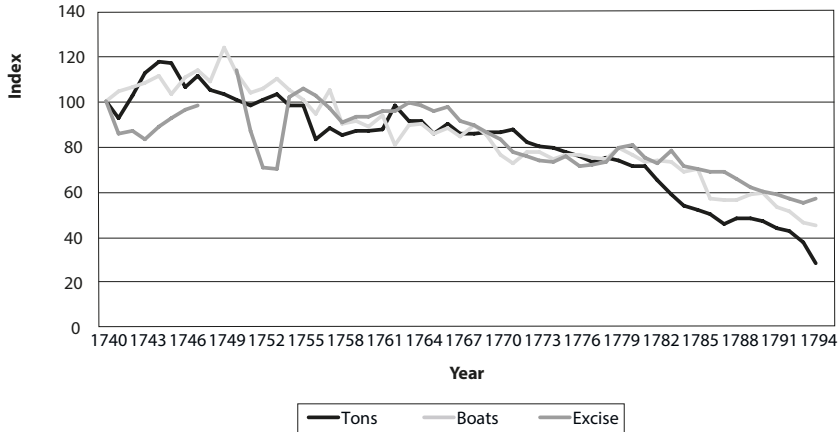
The effects of these various factors is illustrated by Figure 2, which shows revenues of a direct tax on beer, the number of ships carrying water imported by the brewers for the period 1707-1806, as well as the number of barrels returned to the brewers for the period 1740-1794, all expressed relative to their level in 1740<sup>42</sup>. The brewers collected their own used barrels from their customers, going round a different neighborhood once a month. Because this obviously reflects the production of *previous* years and because neighborhoods were not necessarily visited each year (nor the same neighborhoods every year), this should be considered to be a lagging indicator. The three metrics run remarkably in parallel: while the first few decades of the eighteenth century show stagnation and torpidity, the pace of decline starts to accelerate in

40 Unger, *A history of brewing*, 245-284.

41 A.E.C. McCants, 'Poor consumers as global consumers. The diffusion of tea and coffee drinking in the eighteenth century', *The Economic History Review* 61:1 (2008) 172-200.

42 Source of ships: Stadsarchief Amsterdam, Archief van Gilden en Brouwerscollege, 366. Kasboek, 1686-1687 [hereafter: Accounts Brouwerscollege]. Source of used barrels collected: Receipts Brouwerscollege, 1688-1690. Source of direct tax revenues: Stadsarchief Amsterdam, Archief van Gilden en Brouwerscollege, 366. Stukken betreffende de impost, 1728; Stadsarchief Amsterdam, Archief van de Burge-meester, 5052. Register van de jaarlijkse ontvangsten van alle gemenelandscollectieve middelen over Amsterdam en Amstelland, 27.

**Figure 2 Boatloads of water imported by the brewers into Amsterdam, revenues of the excise tax on beer, and number of barrels returned to the brewers, relative to an index year (1740)**

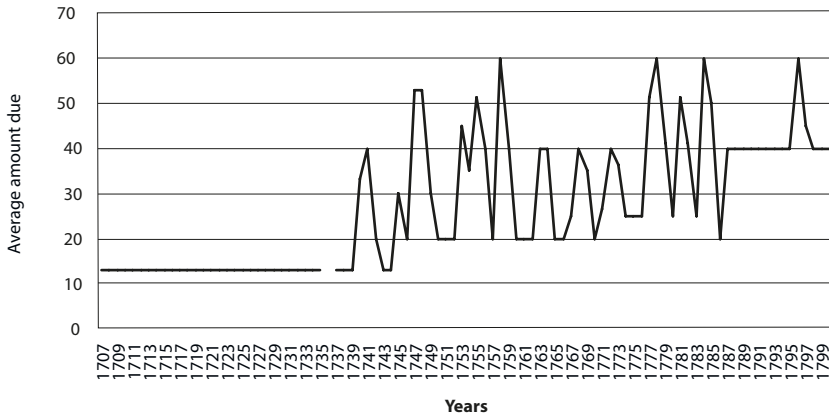


Source of ships: Stadsarchief Amsterdam, Archief van Gilden en Brouwerscollege, 366. *Kasboek, 1686-1687*. [hereafter: *Accounts Brouwerscollege*]. Source of used barrels collected: *Receipts Brouwerscollege, 1688-1690*. Source of direct tax revenues: Stadsarchief Amsterdam, Archief van Gilden en Brouwerscollege, 366. *Stukken betreffende de impost, 1728*; Stadsarchief Amsterdam, Archief van de Burgemeester, 5052. *Register van de jaarlijkse ontvangsten van alle gemenelandscollectieve middelen over Amsterdam en Amstelland, 27*.

the latter half of the eighteenth century. The brewers imported a total of 2,463 boatloads of water in 1707; this had fallen to 2,117 boatloads in 1750, and to 1,306 by 1785. Receipts of the excise tax as well as the number of barrels collected show a similarly vertiginous decline. Meanwhile, falling sales fuelled a cycle of retirement and bankruptcies: out of 23 Amsterdam breweries in 1685, 17 survived to 1750. By 1785, there were only 12.<sup>43</sup>

The consequences of this were twofold: first, joint expenses, such as the costs of water provisioning, had to be borne by an ever-shrinking group. These costs, moreover, were relatively fixed: the largest expense was undoubtedly the icebreaker, which could require eye-watering sums to operate. In the winter of 1783-1784, for instance, 82 horses were needed for the icebreaker (and as many as 745 horses for the 43 boats that followed it, for a total sum of f3,313). In comparison, the costs of breaking the ice in normal years would range in the low hundreds. It also needed considerable repairs after each winter, as did – albeit to a lesser extent – each water boat: according to Van Eeghen, the icebreaker annually

<sup>43</sup> Unger, *A history of brewing*, 223.

**Figure 3 Amount of stuivers paid by the brewers to the brewer's guild**

Source: Accounts Brouwerscollege.

cost up to f5,000 to repair; water boats up to f500<sup>44</sup> (to put this into perspective, a skilled Amsterdam artisan could expect to make about f1,24 per day in this period).<sup>45</sup> These communal expenses were paid for by a sum levied on every boatload of water. As shown in Figure 3, this levy remained stable at 13 *stuivers* per boat up until the 1740s and then quickly escalated, routinely reaching up to 60 *stuivers* per boat in subsequent decades.<sup>46</sup>

Secondly, while the total amount of water imported by brewers continually fell, the population of Amsterdam and its needs remained constant. Consequently, the water syphoned off by this population became a proportionally greater burden to bear. It is important to note at this point that while brewers sold water to the public, they did not perceive themselves to have much choice in the matter, nor did they see it as a source of profit (on the contrary, as demand was greatest precisely when the cost of acquiring a supply was at its highest). This is also borne out by Figure 2: beer production and water imports decline hand-in-hand, indicating that the sale of water itself was not very profitable.

44 Van Eeghen, 'De ijsbreker', 69.

45 S. Broadberry and B. Gupta, 'The early modern great divergence. Wages, prices and economic development in Europe and Asia, 1500-1800', *The Economic History Review* 59:1 (2006) 2-31, 5. Moreover, this was not the total cost of the whole operation. See: Van Eeghen, 'De ijsbreker' and Stadsarchief Amsterdam, Archief van Gilden en Brouwerscollege, 1661. Stukken betreffende de ijsbreker en het openblijten van het ijs, 1700.

46 Accounts Brouwerscollege, 1686-1687.



In fact, the brewers complained that the community misunderstood their responsibilities 'because [they] think that the icebreaker belonged to the city and that the brewers were obliged to provide water for the municipality, which runs contrary to the truth'.<sup>47</sup> Nevertheless, even though they were not formally obligated, they provided this water out of 'friendliness'<sup>48</sup> – or, less euphemistically, 'to keep the poor part of the community in tranquillity'.<sup>49</sup>

That is not to say that customers expected water to be free or its supply to be limitless, as is sometimes posited by historians. Debora Spar and Krzysztof Bebenek, for instance, argue that in the case of water, 'because it is so vital, consumers seem patently unwilling to treat this particular commodity as a commodity. Instead, people see water as something that fluctuates between a human right and a community need, something that is provided (by gods or nature or governments), but that does not have to be paid for'.<sup>50</sup> The implications of this, they argue, were far-reaching: because of this universal demand for free and limitless water, private companies were pressured to keep prices low instead of making necessary investments and ultimately forcing governments to step in.<sup>51</sup>

But this characterization seems itself a little too limitless in its claims: even in those places with a ready supply of potable water – hardly a given – collecting water for consumption always had a cost, even if only in time and labour. Moreover, the consumer behaviour that Spar and Bebenek point to, and that nineteenth-century water companies strove to discipline, seems itself to have been an adaption to rather specific circumstances. The switch from intermittent to constant piped water in nineteenth-century London, for instance, was complicated by the actions of water users accustomed to an uncertain and limited supply: leaving taps open overnight to prevent pipes from freezing, continuously running water through toilets, and so on.<sup>52</sup> In fact, water users required considerable socialization before they became accustomed to

47 '1. omdat dagte dat de ysbrecker aan de stad behoorde 2. en dat de brouwers voor de gemeente water moesten bezorgen, 't geene teegen de waarheid aanliep'. Minutes Brouwerscollege, 1661. Entry of 11-01-1763.

48 Minutes Brouwerscollege, 1661. Entry of 11-01-1763.

49 'om de smalle gemeente in tranquilliteyt te doen blyven'. Minutes Brouwerscollege, 1661. Entry of 31-12-1755.

50 D. Spar and K. Bebenek, 'To the tap. Public versus private water provision at the turn of the twentieth century', *Business History Review* 83:4 (2009) 701.

51 *Ibidem*, 678.

52 J. Hillier, 'Implementation without control. The role of the private water companies in establishing constant water in nineteenth-century London', *Urban History* 41:2 (2014) 228-246.

unlimited water on tap and modified their practices and expectations in turn.<sup>53</sup>

Similarly, what was present in early modern Amsterdam was not an expectation of free and limitless potable water, but rather a sense of a 'moral economy' shaped by the concrete urban environment: as Taylor and Trentmann point out, the practices and conflicts of water use are highly localised.<sup>54</sup> The population of Amsterdam clearly expected to be able to buy water for what they considered a fair price from the brewers, especially in times of shortages, and resented what it perceived as hoarding or price gauging.<sup>55</sup> This was readily understood by contemporaries: when the brewers requested financial aid from the city in 1784 to help pay for the costs of breaking the ice, the mayor drily replied that 'he had heard the headman [of the brewers] repeatedly say that the brewers were not obliged to provide water to the community, but privately he would certainly like to see the brewers try and refuse to',<sup>56</sup> essentially daring the brewers to disappoint the expectations of a thirsty crowd. As it happens, that very same evening a large group of people confronted the assembled brewers 'with many curses and abuse', urgently encouraging them to open up the waterways.<sup>57</sup> That is to say, by all appearances, the brewers did not see the sale of water essentially as an opportunity for profit but as a civic duty or – from a more cynical perspective – as the prize they paid to avoid confrontation with an angry crowd.<sup>58</sup>

That is not to say that there were no advantages beyond avoiding the righteous rage of a rioting mob to providing this supply of water in times of need. The brewers cleverly wielded this fact in their discussions with the city authorities, for instance in 1753 when complaining that imports of foreign yeast undermined their market share and made it more difficult for them to bear the many costs 'which they make both for the upkeep of the icebreaker as for the fetching of fresh water mainly in the

53 V. Taylor and F. Trentmann, 'Liquid politics. Water and the politics of everyday life in the modern city', *Past & Present* 211 (2011) 199-241; Hillier, 'Implementation without control'.

54 Taylor and Trentmann, 'Liquid politics', 239.

55 Minutes Brouwerscollege, 1661. Entries of 19-01-1757 and 28-02-1763. Cf. E.P. Thompson, 'The moral economy of the English crowd in the eighteenth century', *Past & Present* 50 (1971) 76-136.

56 'dat hy by herhaeling den hoofdman had hooren zeggen dat de brouwers niet verpligt waeren de gemeente van waeter te voorzien maar in zyn privé wel eens wilde zien dat zulx door de brouwers gewygers wiert'. Minutes Brouwerscollege, 1662. Entry of 29-01-1784.

57 Minutes Brouwerscollege, 1662. Entry of 29-01-1784.

58 For the provisioning of public services in the early modern era more generally, and the role of craft guild in this, see: M. van der Heijden, *Civic duty. Public services in the Early Modern Low Countries* (Cambridge 2011).

winter, and which benefits the community at least as much if not more than it does the brewers'.<sup>59</sup> Nevertheless, the city government was not often convinced by this argument, and the worsening situation of the brewers translated into a growing chorus of discontent.

The winter of 1783-1784 served as a breaking point. The ice was so thick that the brewers were forced to send out the icebreaker by itself, without any water barges in tow, as the 82 horses that were required to plough through the ice already filled the towpaths to capacity<sup>60</sup>. Subsequent boats had to be pulled by an extraordinary amount of horses nevertheless, in order to break through the remaining ice. The urban government eventually did step in to pay for opening up part of the connection to Weesp, but appears to have been rattled by the problems experienced this winter, which had led to rumblings of anger especially in the poorer parts of the city. A report by the Treasury the following spring suggested that the brewers would always be 'slow to contribute', since they lacked the incentive to act quickly unless forced to by popular discontent.<sup>61</sup> In 1785, the city proposed to take over the icebreaker from the brewers – which they readily agreed to, provided they would be guaranteed access to water.<sup>62</sup> The resulting arrangement meant that brewers would henceforth pay a fixed price of one *gulden* (or twenty *stuivers*) per boat that followed the icebreaker to the city. Meanwhile, the city government started work on its building programme, in order to have an emergency supply of water at the ready.

## Conclusion

The early introduction – or at least, early for the Netherlands – of a piped water system in Amsterdam in 1854 has been explained as the result of demographic pressure and a concomitant scarcity of good drinking water. As this paper has shown, this explanation must be rejected: already in the early modern era, the city had a ready supply of rainwater, supplemented by water imported by boats. This latter source did not provide a very large quantity of water, but was particularly important

59 'die zy, zoo tot het onderhouden van de ysbreeker, als van het haalen van verswaater voornamentlyk des winters, en waarvan de gemeente, zoo niet meer ten minste zoo veel genot heeft, als de brouwers selfste kunnen supporteeren'. Minutes Brouwerscollege, 1661. Entry of 31-12-1753.

60 Minutes Brouwerscollege, 1662. Entry of 16-01-1784.

61 Treasury Designs, 799. Report by Vander Hart, April 1784.

62 Minutes Brouwerscollege, 1662. Entry of 10-02-1785.

during very dry or very cold periods when cisterns ran out or froze over.

Our focus from below, on the water supply as a *technopolitical regime* of artefacts and human actors, also explains why pipes and pumps were not constructed earlier. We have focussed on three main groups of actors: the city's brewers (the main importers of water), the population, and the city government. When the brewers began to encounter increasing problems as the number of breweries and the volume of beer produced declined over the years, it became more and more difficult to bear the burden of breaking the ice in the canals to enable water boats to ply their trade. These costs, moreover, could not be avoided or even passed on to consumers without risking the wrath of an angry mob, as the events of 1784 made all too clear. Citizens expected not an unlimited water supply, but simply to be able to buy water at a fair price even when other sources ran dry.

Wary of the unrest that would follow the disappointment of its citizens' expectations, the city government stepped in. It took over the icebreaker that freed up the canals in winter, and empowered private water importers. Moreover, it embarked on a building program of cisterns, constructing thirty cisterns over the next thirty years. Undoubtedly, these measures were successful on their own terms: no crises developed, no shortages were evident, and they satisfied citizens' desire for a supply of water at a fair price even in the coldest depths of winter and the driest heights of summer. Much like the brewers' boats and barrels before them, these cisterns ensured a reliable supply of water, for industry and citizen alike.

Their development was by all accounts a positive choice: a piped water system was considered as early as 1748 but explicitly rejected as too inflexible and too vulnerable to breakdowns or sabotage. Evidently, such a system has disadvantages, as well as the advantages that now seem so self-evidently desirable. By contrast, water importers could readily switch where they filled their boats, while a network of cisterns was eminently expandable, flexible, and resilient.

As such, that a piped water system was finally adapted in the latter half of the nineteenth century must not be regarded as the long-awaited answer to an ancient question. Certainly, and as Frank Geels has made clear, the specific demands of steam engines and post-cholera concerns with purity made consumers more receptive to the advantages that pipes had to offer. These advantages only grew once the system had expanded and could offer a cheaper deal than the water importers. But fundamentally, the newly unified and powerful state as well as post-

Napoleonic peace must have made flexibility and resilience a lesser concern than it had once been, even while the older system of cisterns remained available and provided reassurance that a breakdown in the piped water system would not automatically mean a breakdown in the water supply. The installation of a piped water system was the result not only of new needs and new means to satisfy them, but also of old worries and old concerns that had lost their previous urgency.

## About the author

After graduating from the Vrije Universiteit Brussel in 2009 with an MA in History, **Filip Van Roosbroeck** went on to read for an MSc in the History of Science, Medicine and Technology at the University of Oxford. In 2016, he defended his Ph.D. thesis at the University of Antwerp, which was entitled: *To cure is to kill? Cattle plague, state intervention and veterinary knowledge in the Austrian Netherlands, 1769-1785*. Afterwards, he worked as a postdoc at the Huygens ING institute for Dutch history in Amsterdam on a project regarding water infrastructure and consumption in early modern Amsterdam and Rotterdam. He is now working outside academia and, while occasionally missing the archives, he certainly relishes finally having some semblance of job security and work-life balance.

Email: [filip.vanroosbroeck@uantwerpen.be](mailto:filip.vanroosbroeck@uantwerpen.be)

