

## Urban Water Supply in Roman Cities and its Impact on the West

Cecelia Feldman

PhD, Archaeology, Brown University

*“Water, by furnishing not only drink but all our infinite necessities, provides its grateful utility as a gracious gift.”*<sup>1</sup> –Vitruvius, 1<sup>st</sup> century BC

In this short passage from his treatise on architecture, Vitruvius makes two subtle yet critical points about Roman attitudes towards water: the first is a recognition and an appreciation of the variety of ways in which water is necessary for human life; and the second is that, as a gift to man, water can be used either for utilitarian purposes or exploited for luxury and enjoyment. The archaeological record of water management infrastructure across the Roman Empire reinforces Vitruvius’ statement. Water management technologies such as aqueducts, monumental fountains, and large-scale bathing establishments, and the profligate use of water in urban space are often attested in the scholarly literature as a hallmark of “Roman” cities throughout the empire and a *de facto* expression of “Roman” civilization.<sup>2</sup> As Rome expanded its reach into the provinces, the *pax romana* (Roman peace) promoted the construction of large-scale water management infrastructure, and therefore, enabled an enlargement of possibilities for urban water use throughout the Empire. The spread of Roman water culture and water

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<sup>1</sup> Vitruvius, “*De Architectura*,” in *Vitruvius, On Architecture, Books VI-X*, ed. and trans. F. Granger (Cambridge, MA: Harvard University Press, 1999), Book 8, Preface, 3.

<sup>2</sup> J. J. Coulton, “Roman Aqueducts in Asia Minor,” in *Roman Architecture in the Greek World*, ed. S. Macready and F.H. Thompson. (London: Society of Antiquaries of London, 1987), 72-84; B. Longfellow, *Roman Imperialism and Civic Patronage: Form, Meaning, and Ideology in Monumental Fountain Complexes* (Cambridge: Cambridge University Press, 2011); D. Parrish, ed., *Urbanism in Western Asia Minor* (Portsmouth, RI: *JRA Suppl.* 45, 2001); B. Robinson, *Histories of Peirene: A Corinthian Fountain in Three Millennia* (Athens: American Center of Classical Studies, 2011); and F. Yegül, *Baths and Bathing in Classical Antiquity* (Cambridge, MA: MIT Press, 1992).

management technologies gradually led to a general Western, urban conception of the standard features of urban water supply.<sup>3</sup>

In this paper, I examine some of the principal implications of Roman water management technology and Roman cultural attitudes to water as they are manifested in the Roman province of Asia.<sup>4</sup> In so doing, I limit discussion to the introduction of long-distance, high-pressure aqueducts into urban centers and the impact of this technology on a variety of spheres of urban life. The development and use of long-distance, high-pressure water lines is significantly related to other aspects of water management and use, but the introduction and proliferation of this particular type of infrastructure has had a unique impact on past and present urban water culture. Discussion of Roman precedents in the use and dissemination of this type of water management infrastructure thus provides a foundation from which to explore the impact of these technologies and practices on cities of the medieval period and beyond. It is possible, therefore, to “bookend” the medieval period with consideration of the practices established in the Roman world and our own, contemporary experience of urban water use. This analytical lens reveals that several features of urban water supply established during the Roman Imperial period have left a lasting legacy on Western cities and cultural attitudes to water.

### **Long-Distance, High-Pressure Aqueducts**

Before it was a Roman province, western Asia Minor was part of the Greek world, and its strategies for urban water supply and use were influenced by Greek models. Water supply for settlements both large and small primarily drew on local springs and on both domestic and civic

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<sup>3</sup> N. Purcell, “Rome and the Management of Water: Environment, Culture, and Power,” in *Human Landscapes in Classical Antiquity: Environment and Culture*, eds. J. Salmon and G. Shipley (London: Routledge, 1996), 180-212.

<sup>4</sup> The Roman province of Asia is roughly contiguous with modern-day western Turkey.

wells and cisterns.<sup>5</sup> Beginning as early as the seventh and sixth centuries BCE, a tradition was firmly established in the Greco-Roman world whereby individuals and civic leaders provided or protected existing water sources in cities for public benefit. Greek tyrants constructed public fountains to convey a sense of concern for public welfare and to solidify public support:<sup>6</sup> the most famous of these were the Peirene Fountain in Corinth and the Enneakrounos in Athens. The main value provided by the construction of these fountain houses was to keep the water sources free of pollution.<sup>7</sup> The tyrants did not supply the water itself, but rather sought to keep pre-existing and locally available water sources fresh and cool.

By the middle of the fourth century BCE, the Greek civic fountain was typically constructed over a natural source of water or was fed by a short pipeline. These early urban water outlets tapped water outlets in the vicinity of settlement and there were very few long-distance water lines that drew on external sources.<sup>8</sup> Until recently, modern scholarship on Archaic and Classical Greek hydraulic technology followed the opinions expressed by ancient authors,<sup>9</sup> which generally underrated Greek achievements in that sphere, by assuming that the lack of long-distance water transport indicated a lack of the knowledge required to create it. However, it is now widely held among contemporary scholars that the Greeks had the technical capabilities to construct modest pipelines, and several are known from the Greek world, especially from Asia Minor.<sup>10</sup> Rather than a

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<sup>5</sup> Coulton, "Roman Aqueducts in Asia Minor," 72.

<sup>6</sup> Longfellow, *Roman Imperialism and Civic Patronage*; S.B. Pomeroy *et al.*, *Ancient Greece: A Political, Social, and Cultural History* (Oxford: Oxford University Press, 1999); and B. Robinson, *Fountains and the Culture of Water at Roman Corinth* (PhD diss., University of Pennsylvania, 2001).

<sup>7</sup> Longfellow, *Roman Imperialism and Civic Patronage*, 9.

<sup>8</sup> D. Crouch, *Water Management in Ancient Greek Cities* (Oxford and New York: Oxford University Press 1993); and D. Crouch, *Geology and Settlement: Greco-Roman Patterns* (Oxford and New York: Oxford University Press, 2003).

<sup>9</sup> For example, Frontinus "De Aqua ductu," in *Frontinus: The Stratagems and the Aqueducts of Rome*, trans. C. Bennett (Cambridge: Harvard University Press, 1925/1997), book I, chapter 16; and H.B. Evans, *Water Distribution in Ancient Rome: The Evidence of Frontinus* (Ann Arbor: University of Michigan Press, 1994).

<sup>10</sup> Crouch, *Water Management*; M. Lewis, "Historical Context. The Socio-Economic Background and Effects: The Hellenistic Period," in *Handbook of Ancient Water Technology: Technology and Change in History 2* (Leiden: Brill, © 2014 The Middle Ground Journal Number 9, Fall 2014 <http://TheMiddleGroundJournal.org> See Submission Guidelines page for the journal's not-for-profit educational open-access policy

lack of technical ability, it was the frequently unstable political and military conditions which prevented Greek cities from relying on extra-urban water sources or vulnerable water lines.<sup>11</sup>

Because pre-Roman cities in western Asia Minor (and elsewhere) overwhelmingly relied on local sources of water, the location of settlements and the types of water used within the cities were significantly impacted by the nature of local water resources.<sup>12</sup> Furthermore, the reliance on local water engendered a close identification between the water itself and the source from which it came. The relation between city and local water sources, however, began to alter with the changes in water technology and geo-political situation associated with the dawning of the Roman period.

The development of the long-distance, high-pressure aqueducts in Rome in the fourth century BCE ensured that the growing capital city had a constant and reliable supply of high quality water offered to the public for a variety of purposes.<sup>13</sup> Roman authors were not shy about singing the praises of Roman achievements in the sphere of water management technology. For example, the Elder Pliny wrote, “If anyone were to give due and close attention to the abundance of waters for public use (in baths, pools, canals, households, parks, suburban estates), the distance from which the water is brought, the lofty arches, the tunnels through mountains, the bridges across valleys, he would confess that there is no sight more marvelous in the entire world.”<sup>14</sup>

This technology and the urban amenities the aqueduct made possible began to be employed in Asia Minor beginning in the third century BCE, but many towns brought under the *aegis* of the burgeoning Roman Empire remained wholly or partly dependent on a combination of local sources

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2000), 631-648.; and E.J. Owens, “The Aqueducts of Sagalassos,” in *Sagalassos III: Report on the Fourth Excavation Campaign of 1993*, ed. M. Waelkens and J. Poblome (Leuven: Leuven University Press, 1995), 91-113.

<sup>11</sup> Coulton, “Roman Aqueducts in Asia Minor”; Owens, “Aqueducts of Sagalassos,” 91.

<sup>12</sup> See, for example, Crouch, *Water Management in Greek Cities*.

<sup>13</sup> T. Hodge, *Roman Aqueducts and Water Supply*, (London: Duckworth, 1992); T. Hodge, “Water Supply: Purity of Water,” in *Handbook of Ancient Water Technology*, ed. Ö. Wikander (Leiden: Brill, 2000), 95-99; and Ö. Wikander “Historical Context. The Socio-Economic Background and Effects: The Roman Empire,” in *Handbook of Ancient Water Technology*, ed. Ö. Wikander (Technology and Change in History 2. Leiden: Brill. 2000), 653.

<sup>14</sup> Gaius Plinius Secundus, “Historia Naturalis,” in *The Natural History. Pliny the Elder*, ed. J. Bostock, et al. (London: Taylor and Francis, 1855), 36.123.

in the form of springs or river-water and cisterns and wells.<sup>15</sup> By the time Rome became the uncontested power in the region (ca. first century BCE), only a handful of cities in Asia Minor were equipped with aqueducts supplying water from a source external to the city and, until the Augustan period, these water lines always ran underground with no significant surface structures. Even where cities were supplied with such long-distance pipelines, this infrastructure was an inconspicuous feature in the landscape, probably owing to volatile political conditions.<sup>16</sup>

With the political and military stability that accompanied Roman imperial expansion, it was increasingly possible for cities to be outfitted with this outsized and conspicuous infrastructure. Sometime between 4 and 14 CE the aqueduct bridge of Sextilius Pollio was constructed at Ephesos, marking the first instance in Asia Minor of an above-ground arcade so closely associated with Roman aqueduct engineering.<sup>17</sup> The reign of Augustus (31 BCE – 14 CE) ushered in a period of peace that allowed for more complex water networks with very visible architectural structures—a development that perhaps was advanced with some official encouragement by the emperor himself.<sup>18</sup> The combination of the political stability of the Roman Empire and the financing from the emperor, other imperial officials, and/or local elites, aided in the diffusion of such cost-intensive infrastructural projects. Over the next several centuries, many cities in Asia Minor were outfitted with extra-urban pipelines, which fundamentally changed the fabric of cities throughout the Mediterranean and had a lasting influence on Western attitudes to urban water supply.

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<sup>15</sup> T. Hodge, “Water Supply: Collection of Water,” in *Handbook of Ancient Water Technology*, ed. Ö. Wikander (Leiden: Brill, 2000), 22, 23, 27-28.

<sup>16</sup> C. Feldman Weiss, “Living Fluidly: Uses and Meanings of Water in Asia Minor (second century BCE-second century CE),” (PhD diss., Brown University, 2011).

<sup>17</sup> P. Scherrer, “Die Fernwasserversorgung von Ephesos in der römischen Kaiserzeit: Synopse der epigraphischen Quellen,” in *Cura aquarum in Ephesus. Proceedings of the Twelfth International Congress on the History of Water Management and Hydraulic Engineering in the Mediterranean Region. Ephesus/Selcuk, Turkey, October 2-10, 2004*, ed. G. Wiplinger (Leuven: Peeters, 2006), 45-60.

<sup>18</sup> Coulton, “Roman Aqueducts in Asia Minor,” 73. This hypothesis is supported by the fact that Augustus, along with his adopted son Tiberius, personally sponsored the water-line connected to the aqueduct bridge of Sextilius Pollio in Ephesos.

The adoption of long-distance, high-pressure water lines in cities of Asia Minor and across the empire had an impact on access to water in urban spaces and corresponding attitudes to water in four principal and interrelated ways. The major areas of influence are demonstrated in the sources of the water, access to and variety of different types of water, urban sanitation, and the political and economic implications of water infrastructure. These are all particular ideas about urban access to water that will resonate with citizens of the Western world.

### *Source of Water*

With the ability to build long-distance water-lines, cities across the Roman Empire could be more selective about the source(s) of the water brought into the city. The water source needed to be at a high enough elevation to channel the water to the settlement by means of a gravity pipeline, but engineers could scout for the source that was the best fit for its intended purposes. Particular sources of water could be chosen for their *quality*, rather than simply for their *availability*. For example, Frontinus describes the suitable uses for the high-quality water brought into Rome by the Aqua Marcia and the less-wholesome water from the Old Anio aqueduct: “so that first of all Marcia should serve wholly for drinking purposes, and then that the others should each be assigned to suitable purposes according to their special qualities, as for example, that Old Anio, for several reasons (because the farther from its source it is drawn, the less wholesome a water is), should be used for watering the gardens, and for the meaner uses of the City itself.”<sup>19</sup> Romans of the *urbs* (i.e., Rome itself) and cities in Greece and Asia Minor overwhelmingly chose to tap freshwater springs for their drinking water, and generally preferred water that came from karstic sources with high calcium

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<sup>19</sup> Frontinus, “De Aqua ductu,” 2.92.

content.<sup>20</sup> Many ancient authors attest to this particular preference for drinking water, claiming that it was the coolest and sweetest.<sup>21</sup>

As the sources for civic water supply were increasingly drawn from locations at considerable distances from the urban settlement, a developing disassociation between the source of the water and the water itself must have been a related consequence of this development. The process of collecting water thus became associated more with the infrastructure than with the water's original source.

### *Access and Variety*

The introduction of gravity pipelines and water under pressure allowed for much wider distribution and a greater variety of uses once the water reached the urban center. Due to the construction of aqueducts and water pipes and drains laid out on urban grid, greater quantities of water became available to more of the urban population.<sup>22</sup> The pressure system meant that water could be distributed more widely and efficiently, and thus could be channelled toward an ever-increasing variety of uses.

The increase in available water allowed for an increase in population in urban centers because more people could be supplied with water for their basic needs. Water was increasingly supplied to private homes, providing amenities like running water for faucets in kitchens and bathrooms, and flushing toilets.<sup>23</sup> For those people who did not have water piped into their homes, access to water was still improved. Facilities providing water for public benefit such as bathing establishments, public latrines, and public fountains became a standard feature in Roman cities.

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<sup>20</sup> Karst is defined as a region with limestone bedrock that has been eroded by the action of water, producing an irregular subterranean landscape with sinkholes, underground streams, and caverns.

<sup>21</sup> Vitruvius, "De Architectura," in *Vitruvius: The Ten Books on Architecture*, ed. M.H. Morgan (Cambridge, MA: Harvard University Press, 1914); Gaius Plinius Secundus, "Historia Naturalis."

<sup>22</sup> M. Lewis, "Historical Background," 640.

<sup>23</sup> M. Lewis, "Historical Background," 640.

Water under pressure created circumstances under which water could be used as a decorative element in urban hydraulic displays, making it not just utilitarian but also beautiful and luxurious, echoing the sentiment by Vitruvius quoted above. Alternatively, greater quantities of water, and the energy created by its flow, allowed for craft production and manufacturing activities that required water to take place within the urban space, and on an increasingly large scale. During the Roman imperial period activities that were previously limited to extra-urban areas, such as ceramic manufacture, textile production and processing, and stone cutting and grain milling, increasingly became located within the urban center.<sup>24</sup> The development in pressure pipelines led to specific areas of industrial production within the cityscape (e.g. Potter's quarters in Pergamon and Sagalassos, stone sawing in Ephesos).

### *Urban Sanitation*

The introduction of long-distance, high-pressure aqueducts cut down on health concerns, and the development and use of self-flushing drainage system had lasting implications for urban sanitation. For example, the ability to be discerning about the source of drinking water decreased health risks stemming from the consumption of poor-quality water. The constant influx of new water enabled the continuous flushing of the city's drainage system and alleviated problems associated with stagnant water. This system provided the city with a means to dispel human, animal, and industrial wastes in an effective manner and led to particular expectations about the acceptable features of urban sanitation.

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<sup>24</sup> Feldman Weiss, "Living Fluidly"; A. Wilson, "Timgad and Textile Production," in *Economies Beyond Agriculture in the Classical World*, ed. D. Mattingly and J. Salmon (London and New York: Routledge, 2001), 271-96; and A. Wilson, "The Archaeology of the Roman *Fullonica*," *Journal of Roman Archaeology* 16 (2003), 442-446.

### *Political and Economic Implications*

The high cost and engineering expertise that was required to build high-pressure, long-distance aqueducts meant that this infrastructure was often sponsored by civic leaders or urban elite and carried out by specialists.<sup>25</sup> Although individual households often relied on domestic water sources in addition to the municipal water supply, high-quality drinking water was largely provided as a public good by powerful magistrates and wealthy elites. This arrangement provided an opportunity for the emperor, provincial magistrates, and the ruling elite to use this infrastructure and the water it supplied as a means to garner public support. Through the inscriptions, architectural style, and decorative elements that adorned this infrastructure the ruling class was able to create and communicate particular narratives to the public.<sup>26</sup> An illustrative example of this phenomenon is the so-called Nymphaeum or Hydrekdocheion Traiani (trans. Fountain of Trajan) in Ephesos (Fig. 1). This monumental fountain was constructed so that the water gushed from beneath the feet of an over-life-sized statue of the emperor.<sup>27</sup> This entanglement of architecture, sculpture, and water communicated a clear message about the power of man over nature and the role of the emperor at the center of the world.

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<sup>25</sup> Feldman Weiss, "Living Fluidly," 34-39.

<sup>26</sup> Feldman Weiss, "Living Fluidly," 61-116; and Longfellow, *Roman Imperialism and Civic Patronage*.

<sup>27</sup> U. Quatember, "The Water Management and Delivery System of the Nymphaeum Traiani at Ephesos," in *Cura aquarum in Ephesus: Proceedings of the Twelfth International Congress on the History of Water Management and Hydraulic Engineering in the Mediterranean Region. Ephesus/Selcuk, Turkey, October 2-10, 2004*, ed. G. Wiplinger, (Leuven: Peeters, 2006), 73-77.

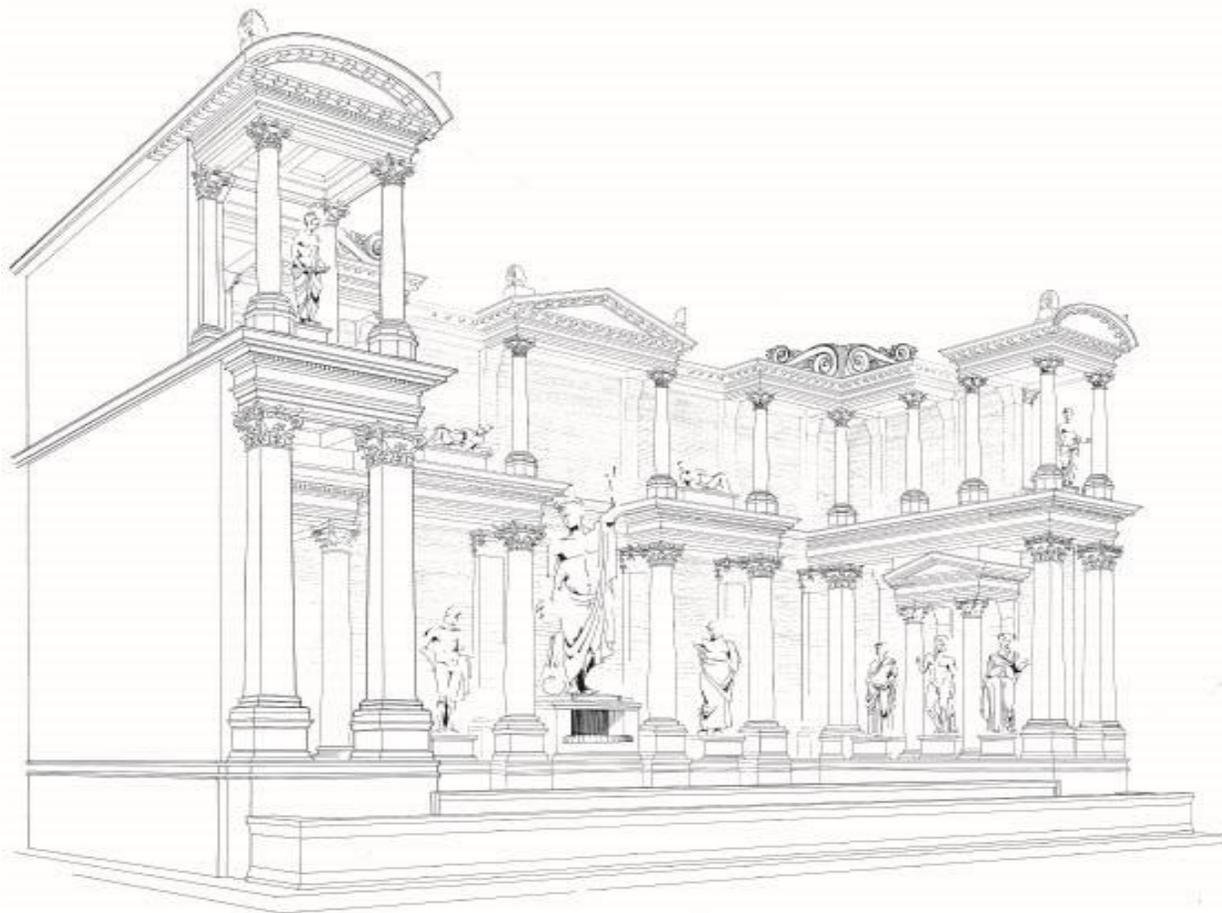


Fig. 1 Reconstruction of Hydrekocheion Traiani, Ephesos (102-114 CE) (image courtesy of the Österreichisches Archäologisches Institut)

Long-distance, high-pressure aqueducts were highly engineered propaganda that brought the “natural resource” of water into cities, leading to a further disassociation between “nature” and water. As Roman cities were accorded elaborate urban water management infrastructure, the means by which people accessed water evolved into a highly mediated architectural medium, as opposed to gathering water from a spring, river, or public and domestic wells and cisterns. For the typical urban citizen, the result of this development was that their engagement with water was increasingly mediated through the infrastructure rather than from the source of the water itself.

## **Conclusion: The Impact of Infrastructure in Antiquity and Beyond**

In this paper, I have considered some of the ways in which the introduction of Roman water management technology and a favorable geo-political situation changed the water delivery system to Asia Minor and, as a result, affected urban life. For example, the ability to bring more water from specific sources into urban spaces had an impact on populations and enabled cities to be selective about the particular uses to which they channelled water of variable quality. The introduction of water under pressure into cities opened up numerous possibilities for civic water use, from indoor plumbing to industrial production. The pressure system also led to improvements in urban health and sanitation. Finally, water was increasingly considered to be a standard public good that was sponsored by the ruling elite and constructed by specialists. All of these developments in urban water management and use, however, tended to sever the connection between the water source itself and its availability within the urban sphere. Thus, the impact of water on life in ancient Roman provinces might serve as a model for considering how water availability and water management has affected the structure and functioning of cities and towns during other historical periods, including our own.

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